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A GUIDE TO CONFIGURATION MANAGEMENT

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PRJ-129 EXAM PREVIEW

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Exam Preview:

1. For new construction, the design requirements must be identified and documented as part of the design process and incorporated into a formal configuration management process before start of construction.
    a. True
    b. False
2. Which of the following DOE Directives and Standards covers the Conduct of Operations Requirements for DOE Facilities?
    a. DOE O 433.1
    b. DOE O 5480.20A
    c. DOE O 5480.19
    d. DOE G 430.1-5
3. According to the reference material, this standard was originally issued in 1995 to address configuration management for the operating phase of facilities and activities.
    a. True
    b. False
4. Using Figure 3-1 Relationship of Configuration Management to Design, Safety, and Authorization Bases, which of the following aspects is NOT encompassed by Configuration management?
    a. Safety Basis
    b. Authorization Basis
    c. Design Basis
    d. Facility Operations

5. Using Figure 3-4 Design Requirements, and the surrounding reference material, which of the following documents is NOT included in the design analysis and calculations input?
    a. Specifications
    b. Analyses
    c. Calculations
    d. Studies
6. The main purpose of using a graded approach is to determine and apply a level of resources that is appropriate when implementing a program. The goal is to apply the highest level of resources to the most important equipment in the most important facilities and to avoid such expenditures where they are not warranted.
    a. True
    b. False
7. The objective of assessing configuration management is to detect, document, determine the cause of, and initiate correction of inconsistencies among design requirements, documentation, and physical configuration. Which of the following assessments matches the description: which are conducted to verify that systems and components continue to meet design and performance requirements in their current configurations?
    a. Construction assessments
    b. Design assessments
    c. Physical configuration assessments
    d. Periodic performance assessments
8. According to the reference material, a hazard category 3 nuclear facility is one that has the potential for significant off-site consequences.
    a. True
    b. False
9. A facility remaining lifetime of less than ___ years may impact the decisions on the effort to be used to reconstitute design requirements for an existing facility.
    a. 5
    b. 8
    c. 10
    d. 15
10. Document control procedures should specify guidelines for the maximum time between issuance of the revised controlled document and distribution. According to the reference material, the least important documents have a maximum time before distribution of _____.
    a. 24 hours
    b. 72 hours
    c. 5 days
    d. 7 days

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1 INTRODUCTION/PURPOSE

The purpose of this standard is to define the objectives of a configuration management process for facilities (including activities and operations), and to provide detailed examples and supplementary guidance on methods of achieving those objectives. Configuration management is a disciplined process that involves both management and technical direction to establish and document the design requirements and the physical configuration of the nuclear facility and to ensure that they remain consistent with each other and the documentation.

The size, complexity, and missions of facilities vary widely and configuration management processes may need to be structured to individual facilities, activities, and operations. It would generally be inappropriate to apply the same configuration management standards to widely different activities, for example, a reactor facility and a small, simple laboratory. The detailed examples and methodologies in this standard are provided to aid those developing their configuration management processes; however, they are provided for guidance only and may not be appropriate for application to all facility activities. The individuals defining the configuration management process for a particular nuclear activity will need to apply judgment to determine if the examples and methods presented in this standard are appropriate for the activity.

Nevertheless, the basic objectives and general principles of configuration management are the same for all activities. The objectives of configuration management are to:

(1) establish consistency among design requirements, physical configuration, and documentation (including analysis, drawings, and procedures) for the activity, and

(2) maintain this consistency throughout the life of the facility or activity, particularly as changes are being made.

This objective and the relationship between design, documentation, and the actual physical plant configuration of the facility, activity, or operation are illustrated in Figure 1-1.

This guide was developed with DOE Nuclear facilities in mind, but the fundamentals and principles may be modified and adopted for learning about configuration management for any type of industrial facility.

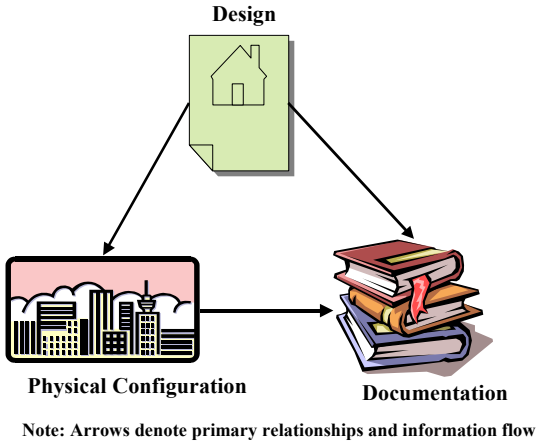

FIGURE 1-1 BASIC RELATIONSHIPS IN CONFIGURATION MANAGEMENT

Fulfilling the configuration management objective is accomplished through the key configuration management elements as illustrated in Figure 1-2.

FIGURE 1-2 KEY CONFIGURATION MANAGEMENT ELEMENTS

The Chapters 3 through 7 in this standard address each of the key elements in Figure 1-2 and provide additional details on how they can be implemented.

The contractor must have a formal policy that endorses the use of configuration management and defines key roles and responsibilities. The contractor must also ensure that sufficient resources are provided to adequately implement the configuration management process. The contractor should establish and document the configuration management requirements at the earliest practical time prior to facility operation or initiation of the activity. Configuration must be controlled for the life of the facility or the duration of the activity. Prior to the end of life of the facility or activity, the

contractor, in coordination with DOE, must determine if configuration management should be applied to post-operation activities, such as decontamination and deactivation. If there is a contractor change at the end of operation, the operating contractor should work with the post-operation contractor to determine how the configuration management effort should be relayed to the new contractor.

The contractor must formally document and implement the configuration management process to be used for the activity in a configuration management plan. The configuration management plan must address:

- how each of the key elements of configuration management will be implemented (See Chapters 3 through 7);
- what are the systems, structures, and components to be included in the configuration management process and what is the basis/justification for the selection (See CM SSCs in Chapter 3);
- what configuration management training is provided;
- who is assigned key responsibilities and authorities for configuration management;
- how interfaces are controlled (for control of interfaces for documentation, see Section 6.5); and
- what programs and procedures must incorporate configuration management.

The individuals implementing the configuration management process must be given sufficient independence and authority. However, configuration management should not be viewed as a program separate from other safety and management activities. The very nature of configuration management is that it is an integrating activity. For this reason, the individuals who implement configuration management must be knowledgeable about the various activities being implemented for the facility or activity and the impact proposed changes might have on that facility or activity. For example, it might be inappropriate to store a chemical with noxious fumes in an area where new maintenance activities would require frequent access for maintenance personnel. Another, less frequently occupied area might be more appropriate. Individuals who are involved in the day-to-day work of a facility or activity, such as operations and maintenance supervisors, are likely to be more cognizant of the nearby activities and the impact of proposed changes. Therefore, they should directly participate in the configuration management process. In particular, where there is a Cognizant System Engineer for a system, the Cognizant System Engineer should be involved in the configuration management process for that system. In addition, as changes to a facility or activity impact the content of training programs, the training organization should be involved in the configuration management process.

The contractor must incorporate configuration management requirements into its procedures and other work processes, and, consistent with 10 CFR 830.122(e), perform work in accordance with those procedures and work processes. Furthermore, consistent

with 10 CFR 830.122(b), personnel must be trained to establish and maintain proficiency in meeting the configuration management process. Training should include:

- instruction on the objectives of configuration management;
- instruction on the implementation of configuration management, including applicable procedures; and
- update and refresher training (e.g., annually).

The DOE Safety Management System (SMS) or Integrated Safety Management System (ISMS) is defined in DOE Policy (P) 450.4, *Safety Management System Policy*. DOE contractors are expected to use ISMS to integrate safety into all aspects of work planning and execution. All safety management systems and programs should be designed to fit together to permit safe and efficient performance. Consistent with that goal, configuration management should function as an integrated process that marries seamlessly with other safety management processes at the facility or activity, not as a separate and distinct program. In addition, the contractor must flow down the configuration management process to subcontractors and suppliers as appropriate to the work and ensure subcontractors and suppliers are implementing it appropriately.

Configuration management should be established as an integrated process to be used by all personnel when performing activities that affect configuration of items within the process, not as a separate program. If the contractor establishes a separate group with the responsibility for configuration management, that group's role should be to develop and maintain the configuration management procedures, maintain the required documentation, and coordinate and facilitate the reviews of the various line organizations. It may also assume related responsibilities, such as documentation control. However, it should not be the sole group responsible for reviewing the proposed changes to assess impacts on operation.

In addition to maintaining consistency among the design requirements, the physical configuration, and the documentation for the activity, the configuration management process must:

- support the ISMS (reference DOE P 450.4, *Safety Management System Policy*; 48 CFR 970.5204-2, *Laws, Regulations, and DOE Orders*; and applicable DOE contracts);
- help to maintain the safety basis as required by Subpart B of 10 CFR Part 830;
- meet the quality assurance requirements for work processes and assessments in Subpart A of 10 CFR Part 830;
- meet the configuration management requirements of DOE O 420.1A, *Facility Safety*;
- meet the configuration management and work control requirements of DOE Order 433.1, *Maintenance Management Program for DOE Nuclear Facilities*;

- support the requirement for documentation, traceability, and accountability for pressure vessels in DOE O 440.1A, *Worker Protection Management for DOE Federal and Contractor Employees*; and
- ensure changes to the design requirements, physical configuration, or documentation are reflected in procedures and training.

Where appropriate, a graded approach should be used to implement configuration management. The configuration management plan should identify how the graded approach will be applied. For example, if the contractor applies different schedules for updating documents through the document control process based on the importance of the document type to operations, the schedules should be documented in the configuration management plan.

The verbs "should," "may," and "must" are used throughout this standard. While our intent is that the purpose of this standard is to provide guidance, not requirements, some organizations may agree to have this standard included in the contract or in other commitments as a requirement. If this standard is listed as a requirement for a specific facility or activity or set of facilities or activities, the DOE contractor or other organization required to meet this standard must comply with all of the applicable provisions that include the word "must." They are not required to meet the provisions that use the word "should," although they are still recommended.

The word "may" denotes permission to do something and does not impose a requirement.

2 APPLICABILITY

2.1 *Scope of Applicability*

This standard provides guidance and information to be used for the development and implementation of configuration management processes at DOE nuclear facilities. It was written specifically to apply to hazard category 1, 2, and 3 nuclear facilities as determined by DOE STD 1027, *Hazard Categorization and Accident Analysis Techniques for Compliance with DOE 5480.23, Nuclear Safety Analysis Reports*, especially with respect to the references to safety bases and 10 CFR Part 830. However, many of the principles and methods provided in this standard may also be useful to manage changes to non-nuclear activities or to nuclear facilities whose inventory of nuclear materials is below the threshold for hazard category 3 nuclear facilities (e.g., radiological facilities and non-nuclear facilities).

This standard is applicable to DOE and DOE contractor personnel, including National Nuclear Security Administration personnel and their contractor personnel.

2.2 Reference to Configuration Management in DOE Directives and Standards

A number of DOE directives reference or require configuration management, configuration control, or a configuration management program. Some specifically reference this standard. References to configuration management or configuration control can be found in the following DOE directives and standards:

- DOE Order (O) 413.3, *Program and Project Management for the Acquisition of Capital Assets*
- DOE O 420.1A, *Facility Safety*
- DOE O 430.1A, *Life Cycle Asset Management*
- DOE O 433.1, *Maintenance Management Program for DOE Nuclear Facilities*
- DOE O 452.2B, *Safety of Nuclear Explosives Operations*
- DOE O 5480.19, *Conduct of Operations Requirements for DOE Facilities*
- DOE O 5480.20A, *Personnel Selection, Qualification, and Training Requirements for DOE Nuclear Facilities*
- DOE Manual (M) 435.1-1, *Radioactive Waste Management Manual*
- DOE Guide (G) 200.1-1, *Software Engineering Methodology*
- DOE G 423.1-1, *Implementation Guide for Use in Developing Technical Safety Requirements*
- DOE G 430.1-5, *Transition Implementation Guide*
- DOE G 433.1-1, *Nuclear Facility Maintenance Management Program Guide for Use with DOE O 433.1*

- DOE G 435.1-1, *Implementation Guide for use with DOE M 435.1-1*
- DOE G 450.4-1B, *Integrated Safety Management System Guide*
- DOE STD 1051, *DOE Standard Guideline to Good Practices for Maintenance Organization and Administration at DOE Nuclear Facilities*
- DOE STD 1065, *DOE Standard Guideline to Good Practices For Postmaintenance Testing at DOE Nuclear Facilities*
- DOE STD 1121, *Internal Dosimetry*
- DOE STD 3003, *Backup Power Sources for DOE Facilities*
- DOE STD 3006, *Planning and Conduct of Operational Readiness Reviews*
- DOE STD 3011, *DOE Standard Guidance For Preparation of DOE 5480.22 (TSR) and DOE 5480.23Implementation Plans*
- DOE STD 3024, *Content of System Design Descriptions*
- DOE STD 6002, *DOE Standard Safety of Magnetic Fusion Facilities: Requirements*
- DOE STD 6003, *Safety of Magnetic Fusion Facilities: Guidance*
- DOE Handbook (HDBK) 1101, *Process Safety Management for Highly Hazardous Chemicals*
- DOE HDBK 3027, *DOE Handbook Integrated Safety Management Systems (ISMS)*

These Orders, Manuals, and Guides can be found on http://www.directives.doe.gov. These Technical Standards and Handbooks can be found on http://tis.eh.doe.gov/techstds.

2.3 Configuration Management Interfaces

Configuration management supports a number of contractor organizations and initiatives by ensuring conformance with the established design requirements. Figure 2-1 illustrates some of these interfaces.

While the provisions in this standard necessarily overlap other provisions such as those illustrated in Figure 2-1, these are viewed as complementary, not conflicting requirements. The use of this standard does not preclude the use of other standards that address particular aspects of configuration management in greater detail, such as the application of configuration management during construction or control of equipment status. Contractors should use the ISMS process to integrate the work performed to meet the provisions in the configuration management process, as well as other processes. In particular, although some elements of the safety basis requirements can be met through configuration management processes, this standard is not intended to provide definitive guidance on the safety analysis or design basis processes.

The following discussions illustrate some of the interfaces between configuration management and other DOE requirements and guidance.

The Contractor Requirements Document (CRD) in DOE O 413.3 states for project management systems for acquisition of capital assets:

> A configuration management process must be established that controls changes to the physical configuration of project facilities, structures, systems, and components in compliance with ANSI/EIA-649, *National Consensus Standard for Configuration Management*. This process must also ensure that the configuration is in agreement with the performance objectives in the technical baseline.

DOE O 413.3 requires contractors to use ANSI/EIA-649 for configuration management. Wherever the provisions of DOE O 413.3 apply, DOE and the contractor should determine whether to use ANSI/EIA-649 in lieu of this standard or to use this standard to supplement ANSI/EIA-649. In addition, Chapter II of DOE O 413.3 contains specific requirements for Baseline Change Control that may apply (*See* Chapter 5).

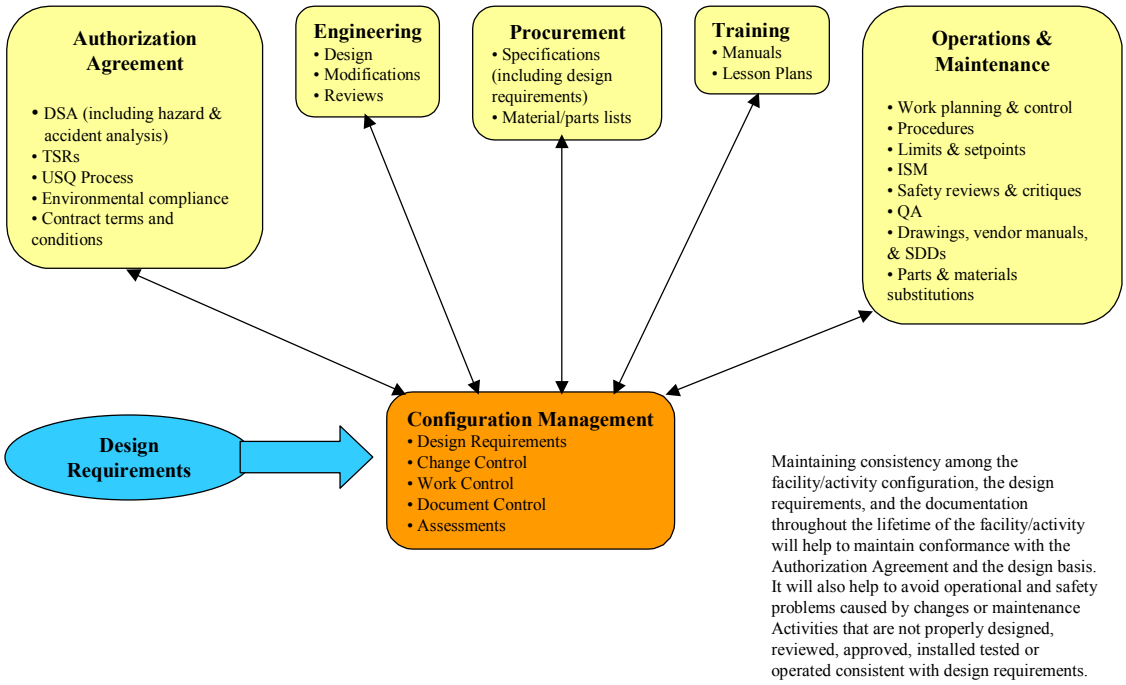

FIGURE 2-1 CONFIGURATION MANAGEMENT INTERFACES

Section 4.5.1.2 of DOE O 420.1 states specific requirements for configuration management for DOE hazard category 1, 2, and 3 nuclear facilities and references this standard for further guidance.

This standard recognizes the need for configuration management of software used to perform functions or analysis related to safe operations, but it does not provide detail on the special considerations related to software configuration management. For example, DOE STD 1121 states that dosimetry codes should be subject to configuration management including records of the version of the code, the user's manual, instructions

for running the code, limitations of the code, hardware requirements, acceptance testing records, and a copy of the code itself. Contractors should refer to DOE G 200.1-1, *Software Engineering Methodology*, or other standards on software configuration management to supplement the guidance in this standard for software.

DOE O 5480.19 and DOE O 433.1 provide additional detail that compliments the work control section of this standard. In particular, DOE O 5480.19 provides requirements for the control of equipment and system status and DOE O 433.1 provides the work control process.

DOE O 430.1A requires a configuration management process to ensure the integrity of physical assets and systems and configuration integrity in designs and acquisitions. DOE G 430.1-5, *Transition Implementation Guide*, encourages the use of configuration management and configuration control during transition from the operational to the disposition phase of a facility/activity life to ensure accurate and up-to-date drawings are used in the transition process.

2.4 Changes to the Scope of this Standard in this Revision

This standard was originally issued in 1993 to address configuration management for the operating phase of facilities and activities. This revised standard is applicable to the design and post-operational (deactivation, decontaminations, and decommissioning) phases as well. Where possible, configuration management should be applied throughout the life cycle of critical structures, systems, and components. In fact, the earlier design requirements, work control, document control, and change control processes are established for a facility or activity, the easier they will be to establish and maintain. It is generally more cost effective to establish and maintain accurate records during the design stage when memories are fresh and design documentation is still available, than to attempt to reconstruct them at a later date.

2.5 Facilities, Activities, and Operations

Where the term "nuclear facility" is used in this standard it is used consistent with the definition for "nuclear facility" in 10 CFR 830.3. That definition states that activities and operations are included in the definition, as well as "facilities." Consequently, wherever the term "nuclear facility" is used in this standard, it is intended to include nuclear activities, facilities, and operations. In addition, throughout this document, wherever the term “activity” appears (in the singular or in the plural “activities”) without the terms “facility” or “operation,” it is meant to apply to activities, facilities, and operations. The term “activity” as it is used in this standard is intended to apply in a broad sense to major activities, such as deactivation and decontamination, and not to small actions, such as repacking a valve.

3 DESIGN REQUIREMENTS

The objective of the design requirements element of configuration management is to document the design requirements. The design requirements define the constraints and objectives placed on the physical and functional configuration. The design requirements to be controlled under configuration management will envelope the safety basis and, typically, the authorization basis. Consequently, proper application of the configuration management process should facilitate the contractor's efforts to maintain the safety basis and the authorization basis. Contractors must establish procedures and controls to assess new facilities and activities and modifications to facilities and activities to identify and document design requirements.

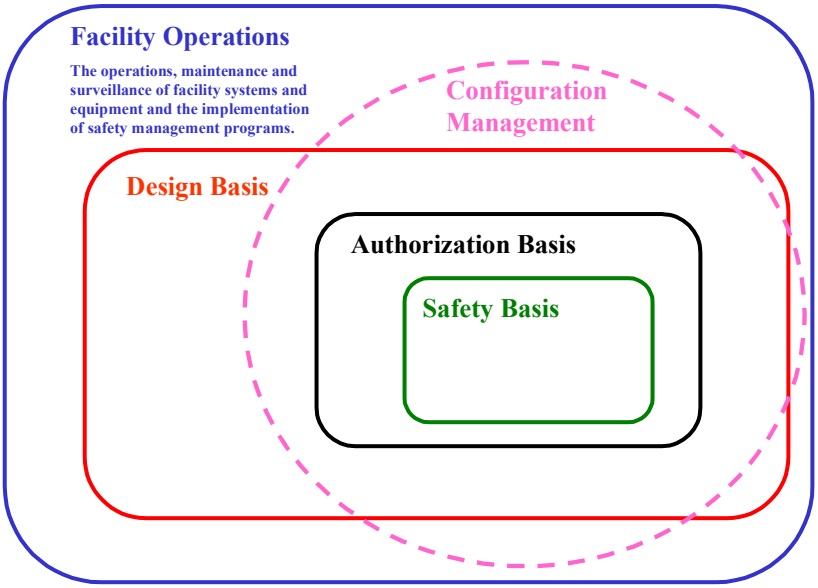

Figure 3-1 Relationship of Configuration Management to Design, Safety, and Authorization Bases

3.1 Generating and Controlling Design Requirements

3.1.1 New Facilities and New Construction

For new construction or activities for which the configuration is not currently being managed, DOE and the contractor must formally agree on the point in time when the contractor will initiate formal control of the configuration. The schedule may contain a series of milestones tied to specific dates or activities. This will allow the contractor to phase-in configuration management as design requirements are established or construction activities are completed and turned over. Generally, when the design is

completed prior to construction the design is "frozen." This is an opportune time to initiate the configuration management process to control future changes.

DOE G 420.1-1 states:

> Document and change control for project design documents and supporting documentation must be provided by the design activity during the design. By the start of construction, document and change control must be provided by an appropriate QA configuration management program. Subsequent changes to project design and supporting documents must be made by means of a formal change control program in accordance with 10 CFR 830.120 [10 CFR 830, Appendix A].

For new construction, (i.e., new facilities and major modifications to existing facilities), the design requirements must be identified and documented as part of the design process and incorporated into a formal configuration management process before start of construction. The contract with the architect engineer and/or construction contractor should specify the expected actions related to configuration management for the design and construction activities, as well as for construction turnover to the operating contractor.

3.1.2 Existing Facilities and Activities

The contractor should have identified the design requirements for safety systems, structures, and components (SSCs) for existing, hazard category 1, 2, and 3 nuclear facilities during the development of the documented safety analysis (DSA) to meet 10 CFR Part 830, Subpart B. For facilities that lack thorough documentation of the design basis, or for SSCs other than safety SSCs, the requirements for previously installed SSCs may not be documented or available. In these cases, it may not make sense from a cost versus benefit perspective to immediately reconstruct the design requirements.

The contractor should document the new or revised design requirements as maintenance and modifications are performed at the facility or activity. In these cases, the contractor must:

- ensure that the DSA demonstrates that the functional requirements for the safety SSCs are sufficient, and

- validate that the safety SSCs will perform their safety functions as assumed in the analysis.

If the information is not sufficient to adequately document the configuration management baseline to validate proper operation of the safety SSCs, then the contractor should determine if additional action is necessary to complete the available information on the design requirements for the nuclear activity so that changes can be adequately assessed.

One way to do this is by using engineering data recovery techniques. Data recovery techniques include searching for and reviewing existing files, archived records, and other sources that might contain the information, and validating the accuracy of the information before it is used.

If the contractor determines that the data recovery techniques are still not sufficient to adequately complete the design requirements, the contractor should consider whether the information should be regenerated (e.g., performing analysis and/or calculations, or interviewing technical experts who are knowledgeable about the particular equipment or situation). If the contractor decides to pursue regeneration of the information, it should take maximum advantage of pertinent existing safety analyses and design information (i.e., requirements and their bases) that are immediately available or can be retrieved through reasonable efforts. Appendix D provides general information that may be used to regenerate documentation. The regeneration process can be expensive and should only be pursued when it is essential to manage the configuration of the nuclear activity safely and efficiently.

When changes are performed, the contractor must document the design requirements associated with the change. By doing this, contractors can incrementally enhance the information on design requirements in a cost-effective manner.

Once the design requirements are established, the configuration management process should be used to control changes because recovery of design information at a later date can be time consuming and costly. Figure 3-2 illustrates the potential sources for gathering the best available design requirements for SSCs under the configuration management process, which will be referred to as the CM SSCs throughout this standard.

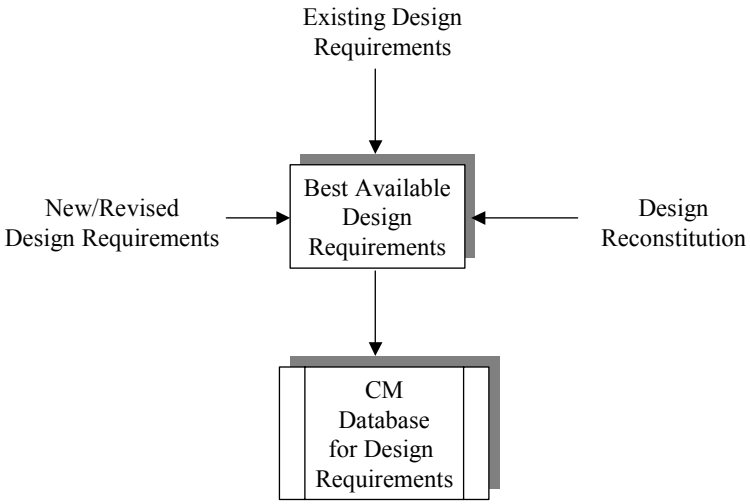

FIGURE 3-2 GATHERING THE BEST AVAILABLE DESIGN REQUIREMENTS FOR THE CM SSCS

3.2 Defining the Scope of CM SSCs

In order to assess the impact a change will have to an activity, the contractor must first understand the design requirements of the activity. These design requirements must be identified and documented, and changes to them must be controlled.

However, configuration management requires resources to implement and, therefore, should not be applied indiscriminately. Some changes, such as plumbing upgrades to a restroom or the relocation of a storage shed for yard maintenance that do not impact safety or mission-required SSCs may not need the more stringent controls required for systems necessary to ensure safety. The contractor should identify and document the set of SSCs for an activity that will be managed through the configuration management process. This set is referred to as the CM SSCs throughout this standard. The CM SSCs are compiled from several sets of SSCs. These sets may overlap.

The first set of SSCs that must be included in the CM SSCs for hazard category 1, 2, and 3 nuclear facilities is the set of Safety SSCs identified in the DSA as required by 10 CFR 830.204(b)(1). Safety SSCs are defined as the combination of Safety-Class SSCs and Safety-Significant SSCs, and they include those SSCs whose preventive or mitigative functions are considered to be major contributors to defense-in-depth and worker safety. "Defense-in-depth" refers to the various layers of protection provided to ensure public safety, worker safety, and protection of the environment. The safety SSCs identified in the DSA constitute the baseline set of SSCs that must be included in the configuration management process.

In addition, contractors should include in the set of CM SSCs the SSCs whose functions are considered to be important to defense-in-depth or worker safety, but are not already included in the Safety SSCs. The combination of the Safety SSCs and the other defense-in-depth SSCs should encompass the “vital safety systems.” The vital safety systems include the safety significant systems, the safety class systems, and other systems that perform an important defense-in-depth safety function. Additional information on vital safety systems is available in documents responding to Defense Nuclear Facilities Board (DNFSB) Recommendation 2000-2 and at https://www.hss.doe.gov/deprep.

The contractor should also review the activity to determine if it is appropriate to include other SSCs in the set of CM SSCs. Other categories of SSCs that should be considered include the following:

- *Mission critical SSCs* - SSCs whose failure could cause substantial interruption to the mission of the facility or activity;
- *Environmental protection SSCs* - SSCs that could have a significant impact on the environment if they failed to perform their function;

- *Costly SSCs* - SSCs that would be expensive to fix or replace or whose failure could result in problems that could be expensive to fix;
- *Critical Software* - Software whose proper performance is critical to the expected performance of a safety SSC, a defense-in-depth SSC, or the safety of the nuclear facility;
- *Master Equipment List (MEL) SSCs* – SSCs that are included in the maintenance program; and
- *Adjacent SSCs* - SSCs that are located adjacent to the safety or defense-in-depth SSCs such that changes to these SSCs could negatively impact the safety or mission of the activity.

Figure 3-3 illustrates the various sets of SSCs that should be considered by the contractor when compiling the set of CM SSCs. The design authority should define the SSCs that fall under each type. Some SSCs will fall under multiple designations.

FIGURE 3-3 COMPILING THE SET OF CM SSCS

Identified "systems" must have defined system boundaries and component lists. Defined systems should contain those components necessary to accomplish the system's function and meet the system's design requirements. Applicable design codes and standards often define system boundaries. In addition, the following considerations may help to define system boundaries for some facilities or activities:

- location of piping class breaks
- location of isolation valves
- location of seismic class breaks
- location of test features

Some supporting features may be outside the system boundary, such as electrical power, instrument air, lubricating oil, and ventilation. In addition, some complete systems may cross multiple facility and activity boundaries, such as ventilation systems.

3.3 Identifying and Documenting Design Requirements

Once the set of CM SSCs is identified, the contractor must identify and document the design requirements for this set of SSCs. The contractor must assess the effects of changes to the design requirements of CM SSCs through the configuration management process. Furthermore, the contractor must maintain the design requirements for CM SSCs throughout the life of the nuclear activity.

The documentation should identify which of the design requirements are required for safety and which are necessary for cost, environmental, or other considerations, so the impacts of changes can be better assessed.

The design requirements to be documented include those that affect:

- function,
- installation,
- performance,
- operation, and
- maintenance.

3.3.1 Design Process

Figure 3-4 illustrates the process of identifying design requirements for CM SSCs. The design process has three elements:

- Design Inputs consist of those specific criteria, limits, bases, or other initial requirements (such as specific functional requirements, specific codes and standards, and specific regulatory commitments) upon which the detailed final design is based. In comparison to design constraints, design inputs are specific in nature; i.e., they are specific to one design activity. For example, a design input for a given air-operated valve might be that it needs to open in ten seconds against a differential pressure of 100 psig. Design inputs should consider the effects of the operating environment (e.g., radiation, temperature, pressure, humidity, chemical spray), material condition, and aging (e.g., erosion, corrosion, fatigue, chloride stress or intergranular stress corrosion cracking, and embrittlement). For example, the design requirements should consider the effects of radiation

exposure and aging on elastomeric materials, such as rubber O-rings and Teflon tape.

- Design Constraints are those general restrictions and limits to the engineering design process that ensure consistency and quality of design (such as general codes and standards, general regulatory commitments, quality assurance requirements, engineering procedures and good practices, and adopted design methodologies). In comparison to design inputs, design constraints are general in nature; they apply to multiple classes and categories of designs and, therefore, to many designs. For example, a design constraint for a safety system might be that it will be able to accomplish its assigned safety function in the event of a single failure.

- Design Analysis and Calculations are those intermediate design products that are necessary to convert the design inputs and constraints into appropriate and complete design outputs. Design analysis and calculations consist of a wide variety of engineering analyses, calculations, studies, reports, and technical review checklists necessary to perform complete engineering design. Design analyses and calculation capture the design assumptions and identify the available design margin. The design margin is the conservatism between the specified design requirement and the minimum requirement that could be developed from the design basis. Examples of design analysis and calculations are:

  - transient analyses,
  - criticality analyses,
  - seismic stress calculations and analyses,
  - Equipment sizing calculations,
  - net positive suction head calculations, and
  - engineering evaluations of equipment qualifications and fire protection.

3.3.2 Design Output

Figure 3-4 also illustrates the design output documents, which are the products of the design process that specify the design output requirements for the facility or activity SSCs. The design output requirements are the composite result of the engineering organization's consideration of the design inputs, design constraints, and design analysis and calculations. Design output requirements specify that which is essential to support the design basis, e.g., the necessary functions, capabilities, capacities, physical sizes and dimensions, limits and setpoints. The design output requirements include the functional requirements, as well as procurement requirements, quality assurance requirements, construction/installation specifications and instructions, post-installation testing, post-maintenance testing, and periodic surveillance/testing requirements. In some cases, the design output requirements are also referred to as the "as designed conditions." The design output documents identify the design requirements that dictate the physical configuration of the facility. Design output requirements best support the configuration management process objectives when they are documented in a format amenable for

proper use by the various user organizations, including procurement, construction, operations, maintenance, and testing, as well as design engineering. Examples of design output documents are:

- design change packages,
- drawings,
- specifications,
- load lists,
- valve lists,
- design (stress) reports,
- one-line electrical drawings, and
- setpoint lists.

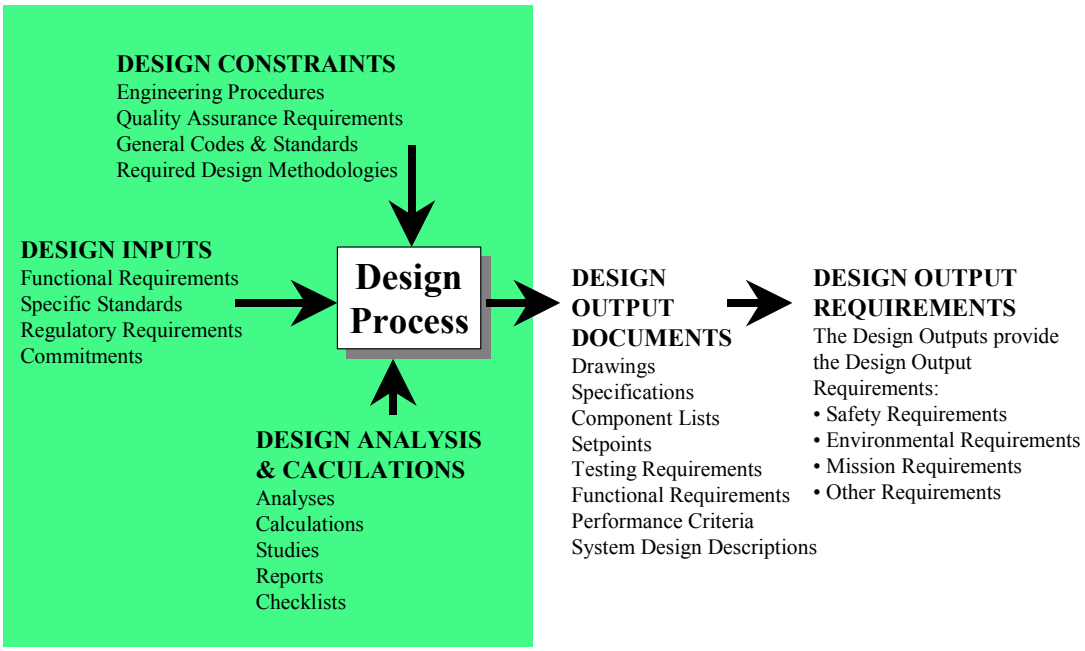

Figure 3-4 Design Requirements

3.4 Taking Interim Measures while the Design Requirements are Being Documented

The contractor should determine if interim measures are needed to preserve the design basis of the nuclear activity and ensure safety while the configuration management process is being developed, the design requirements are documented, and the configuration management process is assessed. The following are examples of interim measures that may be needed:

- additional controls to ensure that newly generated design requirements and design basis are maintained and available,
- additional procedural guidance on sources of design requirements to ensure that an adequate design basis review is performed for potential changes to the nuclear activity,
- additional procedural guidance to ensure that designers thoroughly research the existing design basis before issuing new designs,
- additional procedural guidance to ensure that the design process produces an adequate set of design requirements and design basis for each new design or design change,
- actions to retain source documents containing design requirements and design basis information, and
- actions and controls to ensure that the knowledge of experienced engineering and operations personnel regarding facility design requirements and design basis is not lost when they transfer or retire (this includes actions to collect and record design information from personnel who recently transferred, retired, or are near retirement).

3.5 Establishing a Design Authority

Contractors should establish the design authority for each SSC. The design authority is the single organization responsible for establishing and maintaining the design requirements, ensuring that design output documents accurately reflect the design basis, and maintaining design control and ultimate technical adequacy of the design process.

When facilities or systems are turned over from one organization to another, the design authority may also change. This may occur over a period of time. Procedures should be developed to govern this turnover. However, at any given time, there should be a single, defined authority for each SSC.

3.6 Reviewing Design Requirements

When the design requirements are initially established for the configuration management process, the contractor must perform a technical management review to determine the adequacy of these requirements. The technical management review team must include technical managers that have broad design backgrounds and experience and represent the various design disciplines.

In deciding whether the design requirement documentation for the CM SSCs is adequate, the team should base its determination on the completeness, accuracy, and level of documentation. The team should also consider the results of applicable assessments, especially any initial configuration management assessments when performing its assessment.

The technical management review process may include the following methods of assessing completeness:

- certification of conformance with specified industry codes and standards that identify expected design requirements;
- comparisons of like design requirements for comparable components;
- comparisons of like design basis for comparable design requirements;
- review of design information to identify CM SSCs with missing or incomplete design requirements;
- review of open items and discrepancies that have not been resolved; and
- review by independent, external, technical experts.

The review team should determine if any essential design information is missing. The team should also correlate the design basis with the design requirements, the physical configuration, and the documentation to get insight into the completeness and accuracy of the existing information. A template or checklist may be used as a tool to help verify that the design requirements are complete. This approach involves making a list of the typical types of design requirements for various types of SSCs. The template should be comprehensive and include both the expected and possible design requirements and design basis. This template would then be compared to the list of design requirements available for the structure, system, or component. If something on the list is not included in the design requirements, the team may question the basis for the omission or request that the design requirement be added. Because the template was developed broadly, it will not be unusual for the template to include more design parameters than are applicable to a particular structure, system, or component. Furthermore, the template should not be relied upon as a complete list for every case. The template should be used only as a tool to help the user to notice design requirements that may be missing, and it is not a substitute for good technical judgment. For example, a template for a piping system might include:

- system and component design descriptions or specification,
- basic flow diagrams,
- layout and arrangement diagrams,
- isometric diagrams,
- support details,
- testing requirements,
- material certifications,
- pipe sizing/flow calculations,
- minimum wall thickness calculations,
- corrosion/erosion allowances,
- certification of conformance with piping standards [such as American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code or American National Standards Institute (ANSI) B31.3],
- system interface requirements,

- operating and design pressures and temperatures,
- component input and output design requirements (e.g., pump net positive suction head and power requirements),
- design procedure documentation,
- inspection acceptance criteria,
- documentation of hydrotest parameters and results,
- maintenance and testing procedures, and
- quality assurance requirements.

Tools for assessing accuracy include:

- checks of reasonableness by competent design personnel,
- checks to determine whether the design requirements apply to current physical configuration, and
- independent verification of critical calculations and analysis.

In determining whether the design requirements are properly documented, the team should consider whether:

- the design information is clearly identified;
- the design requirements are differentiated from the design basis;
- safety, environmental, and mission design requirements are differentiated from other types of design requirements; and
- the design documentation is indexed, integrated, and usable.

The contractor must document, retain, and maintain the team's conclusions and the basis for the conclusions regarding the adequacy of the facility design requirements in a retrievable form. The documentation should indicate the relevant design information by system and an index of design documents should be provided.

At the conclusion of this effort, the team must decide if any of the still missing information is truly critical to safe and effective configuration management. If the information is not critical, then the contractor should not invest additional resources in recovering the information at this time. If major construction or modification is performed on the system at a later date, the design information should be developed at that time. If the conclusion of the team is that the design requirements and their design basis are not adequately documented, complete, or accurate and additional information is critical to ensure safe and effective configuration management, then the team must develop a plan to recover that information. If the missing information is necessary to support the safety or authorization basis, then the missing information must be retrieved or regenerated. If the team concludes that a design reconstitution is recommended, the team should develop and document specific recommendations for that effort. Appendix D provides additional information on regeneration and recovery of design requirements.

Chapter 6 provides objectives for the documentation of design information.

3.7 Using System Design Descriptions

A recommended approach to documenting design requirements and providing a link between engineering design documents, the safety basis, and implementing procedures is to develop system design descriptions (SDDs). SDDs identify requirements, explain why those requirements exist (e.g., provides the bases for the requirements), and describe the features of the system design provided to meet those requirements. SDDs can be used to promote consistency among the engineering requirements, the actual installed physical configuration, and the associated documentation. SDDs help facility personnel understand system functions and requirements. In addition to providing a system drawing and written description, they include discussions of functional process requirements, system and component design requirements, system interfaces and interlocks, setpoints, and design requirements related to operations, maintenance, and testing, detailed design and operating descriptions, diagrams, and load lists. Information on the use and specific content of SDDs is provided in DOE-STD-3024-98, *Content of System Design Descriptions*.

3.8 Establishing Equipment Databases

Contractors must develop configuration management equipment databases that cross-reference SSCs with their design requirements, design basis, and associated documents. These databases will be the primary information source for design requirements. Contractors should use the best available design information to fill the database fields.

The configuration management equipment database can be used to contain and correlate key information, such as:

- system designators;
- component designators;
- component descriptive information such as type, manufacturer, model, and size;
- grades/Priority/Classification;
- design requirements or references to design requirements;
- design basis references;
- design topical area references (e.g., seismic, environmental qualification, fire protection);
- range of acceptable setpoints;
- facility document references (e.g., drawings, procedures, DSAs);
- technical Safety Requirement (TSR) references;
- maintenance equipment lists (MELs);
- other desired system and component information;

Linking the management equipment database with other equipment databases with other databases, such as the MEL or other databases listed above, will not only result in greater efficiency because there are fewer databases to maintain, it will also facilitate configuration management as changes will be more thoroughly reviewed and coordinated.

A sample format for a basic, configuration management equipment database is provided in Figure 3-5. The actual format, contents, and capabilities of an organization's configuration management equipment database will depend greatly on the identified needs and intended uses.

The contractor must assign a database owner for the equipment database, with established roles and responsibilities. As most of the information is design information, the design authority is a likely choice. As such, the design authority would be the focal point for resolving discrepancies and updating the database. Other organizations should use the configuration management equipment database as their primary source of design information.

In order to facilitate tracking of CM SSCs and their design requirements, contractors should establish a unique and readily identifiable numbering system for SSCs, their parts, and assemblies. Unique identifiers that incorporate system designators, component type, and numbers, (e.g., SW-MOV-91) are more useful than strictly numeric identifiers (e.g., 135711317). Unique identifiers are important to support equipment and facility operations as well. See DOE O 5480.19 for additional discussion of equipment designation and labeling.

SSC Systems	SSC Components	Descriptive Info			Safety Design Rqmts	Environ. Design Rqmts	Mission Design Rqmts	Design Rqmts for High Cost Items	Design Rqmt Ref's	Design Basis Ref's	Seismic Program	Fire Protection Program
System 1	Comp 1				√	√	√	√	Ref. 1, Ref. 2	Ref. 1, Ref. 2		√
System 1	Comp 2					√			Ref. 1, Ref. 2	Ref. 1, Ref. 2	PC-3	
System 1	Comp 2						√		Ref. 1, Ref. 2	Ref. 1, Ref. 2		
"	"							√	Ref. 1, Ref. 2	Ref. 1, Ref. 2	PC-2	√
"	"				√				Ref. 1, Ref. 2	Ref. 1, Ref. 2		√
"	"					√	√		Ref. 1, Ref. 2	Ref. 1, Ref. 2		√
System 1	Comp M						√		Ref. 1, Ref. 2	Ref. 1, Ref. 2	PC-1	
								√	Ref. 1, Ref. 2	Ref. 1, Ref. 2	PC-1	√
System 2	Comp 1					√			"	"		
System 2	Comp 2				√				"	"		
System 2	Comp 3						√		"	"		
"	"					√			"	"	PC-4	
"	"				√				"	"		
System 2	Comp M				√				"	"		

FIGURE 3-5 SAMPLE CONFIGURATION MANAGEMENT EQUIPMENT DATABASE

3.9 Assuring a Smooth Turnover from Design and Construction

To ensure a successful turnover of new facilities or new modifications, the design contractor and the construction contractors should interface with the operating contractor early in the design and construction phases. When an effective interface is established early in the design process, it is more likely that the design contractor and the construction contractors will provide the needed design products to the operating contractor and turnover will be successful. The design and construction contractors, together with the operating contractor, should establish and agree upon the formal criteria for construction turnover. At a minimum, the criteria should include the following provisions:

- specify at design inception the format and content of design basis and design output documents to ensure that they will be compatible with the operating contractor's work processes,
- periodically monitor the preparation of design basis and design output documents,
- specify the review and approval process for the format and content of final design basis and final design output documents, and
- accept responsibility for their configuration management at turnover.

Although it is highly desirable, it is not always possible for the operating contractor to be involved with the designer/constructor during the design and construction phases. For example, a major new facility might be ordered and designed before final assignment of a management and operating (M&O) contractor. In such cases, the designer should be responsible for ensuring that the operating contractor has the necessary design requirement information at turnover. If the operating contractor is not involved in the design/construction process or if the design and construction contractor fails to provide an effective interface, the operating contractor should identify and implement the actions necessary to recover the missing information.

3.10 Grading

The initial grading of SSCs for the configuration management process begins with the identification of the CM SSCs. That process separates the SSCs that will be assessed through the configuration management process when changes are made from those that will not.

Additional grading may be appropriate. For example, the contractors may want to apply a more stringent configuration management process to safety SSCs, than to costly SSCs. If so, then the contractor must clearly document the different processes being used and the SSCs to which each process applies.

Contractors should also consider that developing and implementing multiple levels of configuration management is not always more cost effective than developing and implementing a single, consistently-applied configuration management process.

Consequently, contractors should use good judgment to determine what level of grading is both appropriate and cost effective.

DOE defines graded approach as a process of ensuring that the level of analysis, documentation, and actions used to comply with a requirement are commensurate with:

- the relative importance to safety, safeguards, and security;
- the magnitude of any hazard involved;
- the life cycle stage of a facility;
- the programmatic mission of a facility;
- the particular circumstances of a facility;
- the relative importance of radiological and nonradiological hazards; and
- any other relative hazard.

The main purpose of using a graded approach is to determine and apply a level of resources that is appropriate when implementing a program. The goal is to apply the highest level of resources to the most important equipment in the most important facilities and to avoid such expenditures where they are not warranted. For a highly hazardous facility such as a large nuclear reactor, which could potentially have serious off-site personnel safety consequences, a significant investment of resources is appropriate for the systems that prevent, detect, or mitigate such consequences. At the other extreme, for a low-hazard facility—a glovebox operation, for example—where the greatest hazard is localized (i.e., offsite persons and workers at other collocated facilities are not affected), the same investment of resources may not be necessary. The grading system should take into account both facility grades and SSC grades in determining the appropriate level of resources to be applied.

In applying the graded approach to the configuration management process, the following factors should be considered:

Relative Importance Factors	Situational/Circumstantial Considerations[1]
Facility grade	Facility type and technical characteristics
SSC grades	Facility remaining lifetime
	Facility operational status and life cycle phase
	Programmatic and technical issues
	Existing programs and procedures

The first column lists factors that can be used to grade based upon relative importance. That is, one item can be identified as more important than another and therefore can be

[1] One item from the 1993 list was removed (Phased Implementation) and two were combined (operational status and life-cycle phase). Phased implementation was removed because it is no longer necessary, because configuration management is no longer a new issue.

assigned a higher priority. The second column lists special situations and circumstances that are independent of relative importance.

In all of the discussions on grading in this standard, where the term "facility" is used it pertains to activities and operations, as well as the traditional use of the term facility (i.e., buildings).

3.10.1 Grading Based on Facility Hazard Category

Facility grading for DOE nuclear facilities is performed using DOE STD 1027, *Hazard Categorization and Accident Analysis Techniques for Compliance with DOE Order 5480.23, Nuclear Safety Analysis Reports*. DOE STD 1027 provides the process for grading DOE nuclear facilities into hazard category 1, 2, and 3 nuclear facilities where

- Hazard category 1 nuclear facilities have the potential for significant off-site consequences.
- Hazard category 2 nuclear facilities have the potential for significant on-site consequences beyond localized consequences.
- Hazard category 3 nuclear facilities have the potential for only local significant consequences.

Contractors may develop a configuration management process that recognizes the need to impose greater requirements to ensure the configuration management for hazard category 1 nuclear facilities than hazard category 2 or 3 nuclear facilities, based upon their relative risks.

3.10.2 Grading Based on SSC Importance

The *Nuclear Safety Management* rule, 10 CFR Part 830, defines Safety SSCs as containing both Safety Class SSCs and Safety Significant SSCs. In addition, Vital Safety Systems may include safety systems that are important to defense-in-depth, but may not be included in the set of Safety SSCs identified for the facility. These sets (i.e., Safety Class SSCs, Safety Significant SSCs and Vital Safety Systems not part of the Safety SSCs), define the relative importance of the SSCs. Additional information on classifying these sets of SSCs can be found in the following DOE guidance documents and standards for safety bases:

- DOE G 421.1-2, *Implementation Guide for Use in Developing Documented Safety Analyses for Subpart B of 10 CFR 830*
- DOE G 423.1-1, *Implementation Guide for Use in Developing Technical Safety Requirements*
- DOE G 424.1-1, *Implementation Guide for Use in Developing Unreviewed Safety Question Requirements*

- DOE STD 3009, *Preparation Guide for U.S. Department of Energy Nonreactor Nuclear Facility Documented Safety Analysis*

Other DOE documents that may be used to facilitate SSC grading define the relative importance of SSCs based upon more specific criteria. For example, DOE STD 1021, *Natural Phenomena Hazards Performance Categorization Guidelines for Structures, Systems, and Components*, defines performance goals for maintaining the integrity of SSCs against natural phenomena as necessary to confine nuclear and other hazardous materials and to protect personnel.

Many quality assurance programs also have a system for grading (quality levels) that indicate the importance of the SSCs to safety, mission, operation, or other considerations. Contractors may grade their configuration management activities consistent with the quality assurance levels.

3.10.3 Grading Based on Facility Type and Technical Characteristics

"Facility" types include the variety of traditional facilities (i.e., buildings), as well as different types of activities and operations. Examples of facility types are:

- reactors
- hot cells
- waste tank farms
- remediation activities
- laboratory facilities
- glove box operations
- storage vaults
- transportation of radioactive materials
- buried waste sites

Each facility type has typical technical and design characteristics. For example, a reactor would be required to meet design codes for high-pressure primary reactor piping systems, while such codes would typically not apply to a nuclear hot cell facility.

The different expectations for each facility type may be considered to determine what types of implementation actions would be technically appropriate for the facility when the configuration management process is fully implemented. The general process criteria should be reviewed in light of the facility type and technical characteristics to determine which configuration management process criteria are appropriate for the specific facility type, which criteria need to be adapted, and if any criteria are not applicable. Typically, however, the program type has less influence on the grading of the configuration management process than on the grading of other technical programs, such as accident analysis.

3.10.4 Grading Based on Facility Remaining Lifetime

The facility remaining lifetime is the period of time that the facility is expected to continue to perform its intended functions. This consideration is pertinent if DOE has formally notified the contractor that the facility is to be operated for only a specified period, or that the facility is to be shut down at a specified date and there is no intent to resume operations.

The facility remaining lifetime is most important in determining the level of effort to expend to develop a new configuration management process for an existing facility. It is easy to establish and document the design requirements for a new facility or activity as it is being designed and constructed or initiated. It is more difficult to reconstruct the design requirements for an existing facility or activity where the documentation on design requirements is not complete or the configuration has not been managed to ensure the documentation reflects the physical configuration of the facility as it currently exists.

The resources required by a contractor to establish the design requirements and a configuration management process for an existing facility can be substantial and may take considerable time. It is easy to see that if a facility has a remaining lifetime of twelve months and the time required to establish the configuration management process is eleven months, that the value added from the configuration management process may not be commensurate with the cost. In such cases, contractors should propose graded configuration management processes that provide some measure of control during the short period of operation, but do not require extensive resources.

It is not essential for the contractor to have exact estimates of the remaining facility lifetime to use the remaining lifetime as a grading factor. Contractors may estimate the remaining facility lifetime only to the extent of determining which of the following categories is applicable:

- more than 10 years
- between 5 and 10 years
- between 2 and 5 years
- less than 2 years

If the expected facility remaining lifetime is very long (i.e., more than ten years), then the facility remaining lifetime is not likely to be a factor in grading, although it should be used for decisions regarding document retention periods.

A facility remaining lifetime of less than ten years may impact the decisions on the effort to be used to reconstitute design requirements for an existing facility. In general, contractors should be able to develop and implement configuration management processes for an existing facility in less than five years, but full reconstitution of the design basis can take up to 10 years for the most complex facilities. For less complex facilities, remaining lifetimes of five years or less may affect decisions on defining the design requirements.

For existing facilities with remaining lifetimes of between 2 and 5 years, contractors should consider the level of effort to be expended in establishing the configuration management process. For example, CM SSCs might be defined to include only those with safety or environmental design requirements. Moreover, the searches involved in reconstituting the design might be limited to formal reviews and smart searches.

Facilities with a remaining lifetime of less than 2 years should undertake only those configuration management activities that are important to the remaining operation or to the next phase of the facility lifecycle. The SSCs included might be limited to those related to safety. Contractors should conduct walkdowns to determine the degree of consistency between the physical configuration and associated documentation, including as-built drawings. The configuration management process should identify change control mechanisms. Physical changes should be reviewed, approved, and documented. Activities to reconstitute the design requirements might be limited to the formal review. Reconstitution of the design basis might not be appropriate.

In all cases where limited facility lifetime is a factor in the grading of the configuration management process, the subsequent lifecycle phases should be considered. For example, while a contractor may discontinue the shipment of new waste to a tank farm, it will still need to control the existing configuration to ensure that the wastes are properly controlled. Another example is a processing facility that is deactivated and, many years later decontaminated and decommissioned. Even though the facility will only be operated for two more years, a process for configuration management will need to be implemented during the periods of deactivation and decontaminations. The configuration management process for the remaining operating period should be established with consideration of the needs of the later phases of activity (deactivation and decontamination).

Finally, many activities at DOE are planned and pursued over short time frames from a couple of years to a few weeks. While the limited duration of the activity may need to be considered in establishing a configuration management process, the short duration of these activities should not be used as a basis for not managing the configuration. In some cases, a single facility will be used for changing missions. In such cases, contractors may

be able to establish a configuration management process that envelopes expected operations or is modified with changing missions.

Because it is easier to establish and implement a configuration management process for a new facility, facility remaining lifetime will be a less significant factor in grading the configuration management process for a new facility.

3.10.5 Grading Based on Facility Operational Status and Lifecycle Phase

The facility operating status and life-cycle stage indicate the amount of emphasis and rigor that is appropriate for the configuration management process. The life-cycle phases of a nuclear facility include:

- design,
- construction,
- operation,
- deactivation,
- decontamination, and
- decommissioning.

During the early part of the design phase, designers may need to make rapid changes unhampered by configuration control, but as the design interfaces are established, design requirements will need to be documented and controlled to ensure systems will function properly and construction can proceed.

During construction, which will likely overlap the final design phase, configuration changes need to be controlled and documented, but the contractor will continue to need a configuration management process that responds rapidly and provides timely resolutions to keep construction on schedule.

If the facility is currently operating (including periodic shutdowns for maintenance and other conditions), the operational status consideration generally does not affect the grading of the configuration management process. However, during a major modification to an existing facility, contractors will need the configuration management process to be as responsive as when a facility is in the construction phase. In particular, the contractor must be vigilant that the changes in one part of the facility that affect another part of the facility are properly evaluated, approved, and documented. In addition, if part of the facility is operating during the modification, some of the configuration considerations of an operating facility will remain in effect. The phase of the facility life cycle during the modification will determine the relative importance of, and thus the degree of emphasis on:

- design basis,
- design requirements,

- current as-built configuration information,
- system acceptance and preoperational testing,
- design control programs,
- periodic operability surveillance programs,
- document control programs,
- facility life extension efforts, and
- decommissioning plans.

If a facility is deactivated or being decontaminated or decommissioned, there are different considerations than during the operating phase. For example, during a maintenance shutdown at an operating facility, a pump with a safety function may be disassembled or removed. Before operation, that pump would need to be restored or replaced with a pump that meets the existing or new design requirements. In addition, performance testing would likely be needed. These changes and tests would need to be processed through the configuration management process. On the other hand, if the same facility is deactivated two years later with no intention of resuming operation, then the pump may no longer have a safety function. If the pump with no safety function is removed and it is no longer needed, configuration management for that action may be reduced to a simple documentation of removal of the pump.

Contractors for facilities in deactivation status that may be returned to an operating status later will need to implement a configuration management process that maintains the design requirements for the facility and accurately documents the configuration of the facility. Accurate documentation will facilitate the later reactivation of the facility. In addition, the contractors should take actions through the maintenance process to ensure that the physical configuration does not degrade and that changes are identified and approved.

If during the deactivation period the scope of SSCs under the configuration management process was reduced to only include the SSCs related to personnel safety during deactivation, contractors may need to re-establish the design requirements of the balance of the CM SSCs for operation. Contractors would also need to perform walkdowns to determine the degree of correlation between the physical configuration and associated documentation. Physical changes would need to be reviewed, approved, and documented. Consequently, when determining the scope and depth of configuration management to be pursued during deactivation, contractors should consider the probability of reactivation, the length of time prior to reactivation, and the cost of reactivation if the configuration management was limited during reactivation. In some cases it will be more cost effective to maintain robust configuration management and maintenance processes. In other cases (e.g., long reactivation periods with a low probability of reactivation) it may be more cost effective to reduce the configuration management process to address only those SSCs important to safety during the reactivation period.

Prior to reactivation of a deactivated facility, the contractor must ensure that the configuration has been restored and a configuration management process appropriate for operation is implemented.

During decontamination, the facility may have fewer active safety systems from the original design, however, there may be more workers and those workers may be closer to the hazards (e.g., contamination or fuels being removed, open pipes, asbestos, steam) than they typically would during operation. Additional safety precautions may be added to the activity (e.g., contamination huts, enhanced radiation monitoring, new procedures). Prior to decontamination, contractors will need to update their CM SSCs to include new SSCs as appropriate. Contractors should also review the CM SSC list and delete SSCs that no longer are needed to meet safety or mission functions or other considerations as appropriate. In addition, as SSCs are removed from the facility and from active status, the contractor will need to remove them from the list of CM SSCs, as appropriate.

3.10.6 Grading Based on Programmatic and Technical Issues

The resolution of a programmatic or technical issue can change the importance of a structure, system, or component. For example, a component may be moved from the list of non-safety components to the list of safety components or a system may be determined to be a vital safety system. When such changes occur, contractors will need to review their impact on the list of CM SSCs and revise it accordingly.

Issues that are likely to trigger programmatic or technical changes include:

- safety evaluations,
- probabilistic risk assessments,
- human factors engineering,
- operating and emergency procedures and planning,
- operator training,
- seismic qualification,
- fire protection,
- safe shutdown, and
- equipment qualification.

3.10.7 Grading Based on Existing Programs and Procedures

In implementing a configuration management process, contractors should:

- take credit for existing programs and procedures where appropriate,
- modify existing programs and procedures where necessary, and
- develop new activities only when essential.

Contractors with existing processes that satisfy the configuration management criteria should continue to use those processes, modifying them only as necessary. This standard should not be used to justify repackaging existing processes that are already adequate. For example, if a facility has an adequate document control process, there would be little benefit in requiring that facility to repackage the process for the sole purpose of matching the format or terminology in this standard. Improvements can be made to existing processes to ensure they address the criteria in this standard, rather than complete revisions to existing processes. Contractors who have questions regarding changes that may be necessary to comply with this standard are urged to consult with their DOE line organizations prior to expending significant budget.

Configuration management activities may already be present in a variety of processes at a facility. Some areas where contractors may find elements of configuration management include:

- DSA upgrades,
- design control,
- quality assurance,
- document control and records management,
- procedure change control,
- temporary modification control,
- maintenance,
- facility status and operational configuration control, and
- lockout and tagout.

Some of these interfacing programs input information important to the configuration management process, some perform functions necessary to ensure configuration management, and others require configuration management to ensure valid information is used.

3.11 Managing Design Changes and Safety Bases under Configuration Management

3.11.1 Design Changes

Figure 3-5 illustrates the relationship between the configuration management equipment database and the design process. Changes to the design requirements must be processed through the change control process discussed in Chapter 5.

Requests for changes to the design of the activity typically include a description of the problem and sometimes include an associated proposed facility configuration change. When a change is requested, the individual preparing the documentation for the proposed change should consult the configuration management equipment database and assess how the design requirements in that database will be affected. That assessment should be part

of the documentation for the proposed change. If it is determined that the proposed change could impact an SSC that is part of the configuration management equipment database, then the proposed change will need to be processed through the change control process. Furthermore, following review and approval of the proposed change, the configuration management equipment database will need to be updated as appropriate to reflect the change.

3.11.2 Safety Basis

Section 3.2 discusses how the Safety SSCs identified in the DSA constitute the baseline set of SSCs that are to be controlled under the configuration management process. It also discusses including other SSCs such as those identified as necessary for:

- defense-in-depth,
- critical mission functions,
- environmental protection,
- protection of costly equipment or functions,
- protection of adjacent SSCs, or
- critical software functions

Configuration management should be used to control and document changes to the safety basis (including the DSA and the Technical Safety Requirements or TSRs). The relationship of the process of documenting the configuration management design requirements to the safety basis required by Subpart B of 10 CFR Part 830 for hazard category 1, 2, and 3 nuclear facilities is illustrated in Figure 3-6.

The relationship of the Unreviewed Safety Question (USQ) process to configuration management is addressed in the discussion on change control in Chapter 5.

3.11.3 Design Basis versus Design Requirements

The design requirements are the output of the design process as shown in Figure 3-4. The design basis provides the technical and analytical basis for the design requirements. The design requirements specify “what” is required and the design basis documents “why” a design requirement is specified. In addition to safety basis documents (DSAs and TSRs), design basis information is found in other documents, such as transient calculations, setpoint calculations, and sizing calculations.

There may be differences between the values in the design bases and the design requirements for a facility or activity. For example, the design basis may specify a requirement for a pump to deliver 160 GPM, while the design requirements may specify a pump rated to deliver a flow of 200 GPM. This difference may represent conservatism that the design engineer felt was appropriate or the higher rating may have been chosen to match the rating of an available, off-the-shelf pump.

The significance of the difference between the design basis and the design requirements is that a change to the design basis would necessitate a new design analysis, but a change to a design requirement would not require a new design analysis if the design basis is not affected.

To simplify the process, design requirements should be specified consistent with the design basis. If the design requires a 160 GPM pump and the contractor intends to purchase a 200 GPM pump, the procurement specification can document this without revising the design requirements.

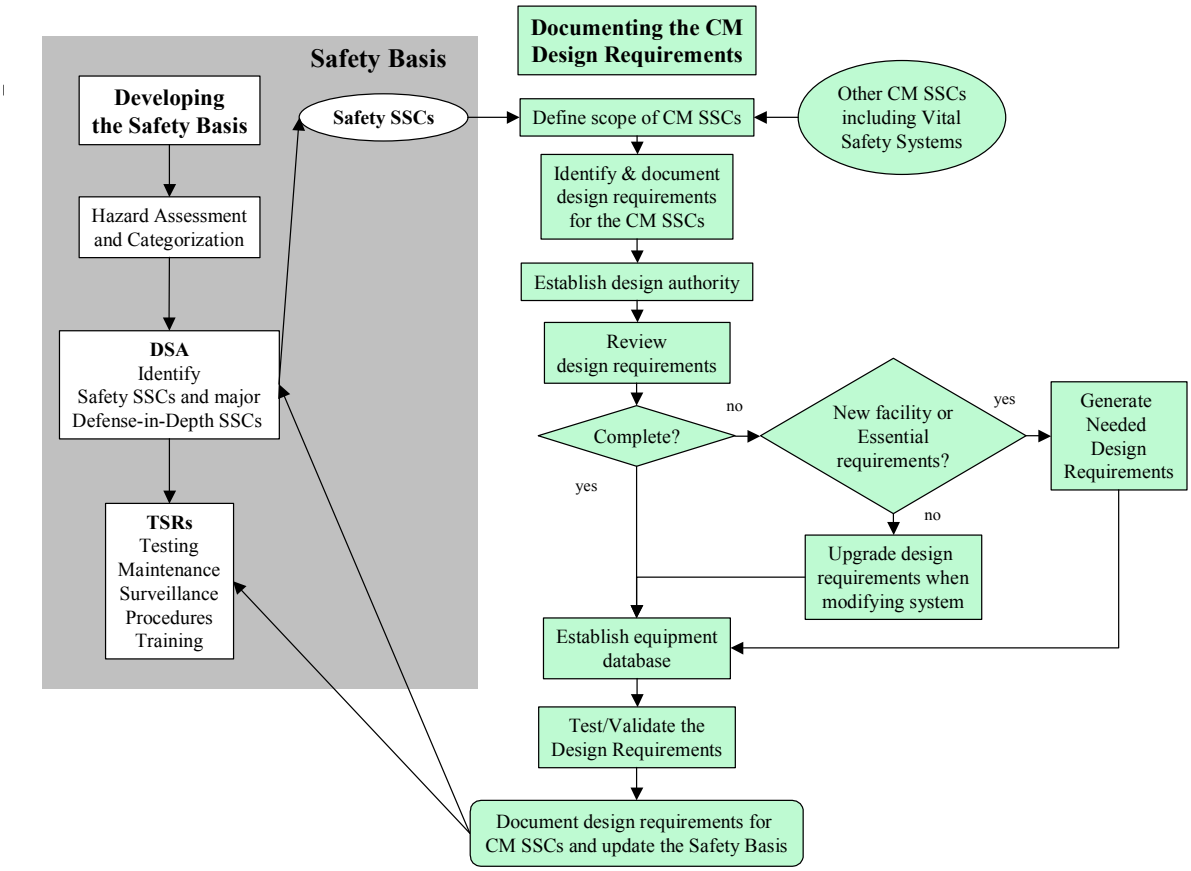

FIGURE 3-6 DOCUMENTING THE CM DESIGN REQUIREMENTS

3.12 Using Cognizant System Engineers in the Process of Documenting Design Requirements

DOE O 420.1A, *Facility Safety*, requires contractors to designate a Cognizant System Engineer for each system for DOE Category 1, 2, or 3 nuclear facilities. The qualifications for the Cognizant System Engineer must be consistent with those defined in DOE O 420.1A. In addition, as stated in DOE O 433.1, *Maintenance Management*

Program for DOE Nuclear Facilities, the Cognizant System Engineer has the lead responsibility for the configuration management of design.

The Cognizant System Engineer must be knowledgeable of the system and the related safety basis. The Cognizant System Engineer must also retain a working knowledge of the facility's operation and the existing condition of the system. Consequently, the Cognizant System Engineer is also responsible for overseeing the configuration of the assigned system to ensure that it continues to be able to perform its expected functions. The Cognizant System Engineer should:

- be knowledgeable of the system safety functions, requirements, and performance criteria and their bases;
- understand how the system SSCs are designed and how they function to meet the requirements and performance criteria;
- understand system operation;
- be knowledgeable of the testing and maintenance necessary to ensure the system continues to be able to perform its safety functions;
- be responsible for ensuring that documents related to the system are complete, accurate, and up-to-date, including SDDs, technical drawings, diagrams, and procedures for surveillance, testing, and maintenance;
- be appropriately involved in the design, review, and approval of changes affecting/impacting system design, operation, and maintenance.

Because the Cognizant System Engineers are expected to have a thorough understanding of system design expectations, operating requirements, and current configuration, the Cognizant System Engineers should have a major role in identifying the CM SSCs. Each Cognizant System Engineer should also participate in the identification of the design requirements for their system and the SSCs within the system. Finally, the Cognizant System Engineer should participate in the configuration management review of any changes that are made to the system for which the Cognizant System Engineer has cognizance responsibility.

4 WORK CONTROL

In order to ensure that work is appropriately evaluated and coordinated before it is performed, contractors must incorporate a work control process into their procedures. Work control is an administrative process by which work activities are identified, initiated, planned, scheduled, coordinated, performed, approved, validated and reviewed for adequacy and completeness, and documented (See Figure 4.1). Work control processes should ensure that when work activities are performed, consistency is maintained between the documents, the procedures, and the physical configuration of the nuclear facility.

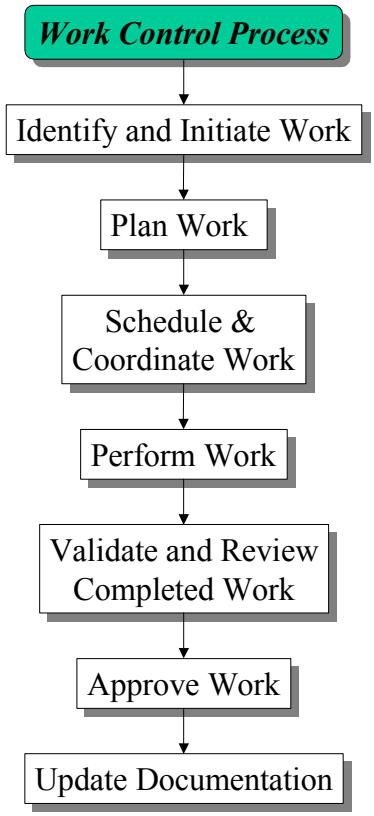

FIGURE 4-1 WORK CONTROL PROCESS

Contractors should apply the work control process described in DOE G 433.1-1, *Nuclear Facility Maintenance Management Program Guide for Use with DOE O 433.1* to work being performed at facilities/activities covered by this standard.

The contractor must clearly communicate the responsibilities, authorities, and expectations of work control to all individuals who do work, including facility personnel, subcontractors, and non-facility personnel. The specific responsibilities, authorities, and interfaces related to work control must be defined in applicable work processes, including procedures.

Contractors must use the ISMS Process to integrate safety into all aspects of work planning and execution. Safety requires both the involvement of the workers and hands-on involvement of line managers. The ISMS Process is designed to promote this involvement. ISMS ensure that environment, safety, and health management is an integral part of performing work. Line managers are responsible for safety, as well as the work being performed.

Authorized personnel approving the work should ensure that the change control process, including the USQ Process, was used for changes that could impact the safety analysis or the hazard controls. If during the performance of work, additional changes affecting the safety analysis or the hazard controls are identified, these changes should be processed using the change control and USQ processes and work should not resume until these changes have been analyzed and approved.

5 CHANGE CONTROL

Contractors must establish and use a formal change control process as part of the configuration management process. The objective of change control is to maintain consistency among design requirements, the physical configuration, and the related facility documentation, even as changes are made. The change control process is used to ensure changes are properly reviewed and coordinated across the various organizations and personnel responsible for activities and programs at the nuclear facility.

Through the change control process, contractors must ensure that:

- changes are identified and assessed through the change control process,
- changes receive appropriate technical and management review to evaluate the consequences of the change,
- changes are approved or disapproved,
- waivers and deviations are properly evaluated and approved or denied and the technical basis for the approval or the denial is documented,
- approved changes are adequately and fully implemented or the effects of the partial implementation are evaluated and accepted,
- implemented changes are properly assessed to ensure the results of the changes agree with the expectations, and
- documents are revised consistent with the changes and the revised documents are provided to the users.

A diagram of the change control functions is provided in Figure 5-1.

5.1 Identifying Changes

5.1.1 Identifying Change Mechanisms

The contractor must ensure that each proposed change to the facility, activity, or operation is considered for processing through the change control process. To ensure that all changes are controlled as appropriate, the contractor must identify all mechanisms that can lead to temporary or permanent changes in:

- the design requirements,
- the physical configuration, or
- the documentation.

For any facility, activity, or operation there are typically multiple mechanisms for initiating change. Changes may be initiated through any of a variety of organizations, such as design, operations, maintenance, procurement, procedures, training, and security. Changes can include physical, document, procedural, operations, software, or design

changes. Contractors should assess each type of change to determine the mechanisms for initiating changes and link them to the change control process. Contractors should integrate the change control process into the work processes for all potential mechanisms of changes by requiring workers and organizations to use the change control process, as appropriate, when a change is to be made. The identification of change mechanisms is often the most critical step to achieving effective change control. Change mechanisms that are not identified cannot be controlled.

Once change mechanisms are defined, contractors should ensure that the change control process is properly integrated into the procedures and other work processes for that change mechanism. Contractors should consider eliminating or combining change mechanisms to make changes easier to control.

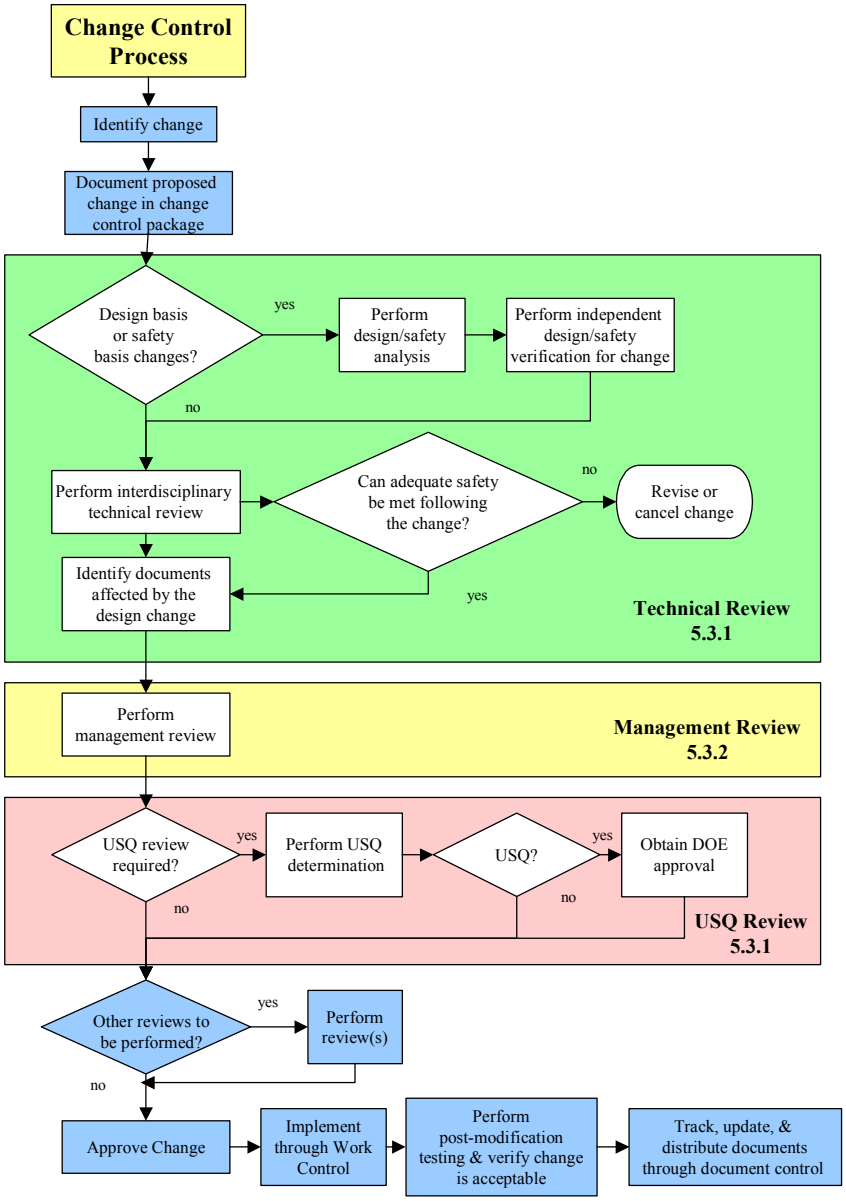

FIGURE 5-1 CHANGE CONTROL PROCESS

5.1.2 Considering the Impact of Minor Changes

It is important to identify and consider even subtle changes under the configuration management process. Changes that are perceived to be minor or insignificant can significantly impact the functions of SSCs required to maintain safe operation or to achieve mission objectives. They can also result in operation outside the approved safety basis. A well-designed change control process should include a screening process to determine if seemingly insignificant changes should have at least a cursory review by an interdisciplinary group to confirm that there are no significant impacts from the proposed change. In addition, the contractor must ensure that the USQ process is invoked and applied to changes consistent with the requirements of 10 CFR Part 830 and the DOE-approved USQ process to maintain the integrity of the safety basis.

5.1.3 Making Equivalent Changes

Changes that are shown to be equivalent changes do not need to be evaluated under the change control process. Equivalent changes are hardware changes that:

- continue to meet the design requirements for the equipment,
- meet all interface requirements, and
- do not impact the safety basis.

An example of an equivalent change would be replacement of a failed part with the same make and model number part. However, as vendors sometimes change materials or design of components without changing the model number, the contractor should ensure that the design requirements continue to be met with the replacement part.

5.1.4 Using a Consistent Configuration Management Process

If multiple change control processes are used, they should be consolidated into a single, consistent change control process that is both useful and effective. Unique change control processes for specific types of changes, such as software changes, should be integrated into the overall change control process for the activity. The change control process may provide provisions for varying levels of review based on a documented graded approach, as well as graded schedules for updating documents based upon their relative importance. Facility managers should ensure that vendors and subcontractors use the established process. All personnel in design, operations, and support organizations that do work for the facility or activity should:

- be trained on the change control process,
- follow the associated procedures closely, and
- be alert to activities that may not be planned or may occur without following appropriate procedures.

5.1.5 Developing Efficient Configuration Management Processes

The change control process should be efficient to ensure that it is used effectively. Forms and procedures should be easy to use and understand, particularly as the change control process will need to be used by individuals from a number of organizations with varied backgrounds and experience. To be effective, forms and procedures should:

- facilitate complete and timely change identification and control,
- be easy to use and encourage participants to use them, and
- provide for management tracking and reporting.

5.2 Documenting Proposed Changes

5.2.1 Documenting Proposed Changes

The change control process must include provisions for the initiator of the proposed change to document the proposed change including:

- a unique identifier for the proposed change
- a description of the proposed change sufficient to support technical and management reviews prior to approval;
- the name and organization of the requester;
- a description of the potentially affected SSCs;
- the reason for the proposed change;
- a list of the alternative solutions considered and the results;
- the date by which the decision about the change needs to be completed to facilitate timely implementation or to allow implementation to occur concurrent with other activities, such as a planned maintenance shutdown;
- constraints; and
- any other information needed to review, track, approve, or process the proposed change.

Appendix E contains a sample change request.

5.2.2 Using Change Control Packages

The design authority should prepare a change control package consistent with the design process and controls for the proposed change. The change request should be verified to be accurate and appended to the change control package. The change control package should also include drawings, analysis, procedures, instructions and other documents needed to properly assess, implement, verify, and validate the proposed change. If a work control document is being used to initiate the change, it should be included in the change control package.

The change control package will be used when performing the reviews of the proposed change. It should define the methods and acceptance criteria for the post-modification testing. The change control package should be revised, updated, and supplemented as the review progresses. It should contain a copy of all approvals. Once the proposed change is approved for implementation, the change control package will be used to facilitate implementation.

Appendix F provides sample change control packages.

5.3 Reviewing Changes

The change control process must involve a formal change control review for each proposed change. The change control review must include a technical review and a management review. The technical review should be interdisciplinary, except where the change is so isolated as to not impact the efforts of more than one discipline. The management review should ensure that management considerations, such as funding, have been adequately considered prior to approving the change for implementation. The results of both reviews must be formally documented. Finally, some changes will need to be reviewed under the DOE-approved USQ process for the facility or activity in accordance with the requirements of 10 CFR Part 830. The USQ review may be performed concurrent with the technical and management reviews, but it must reflect the final configuration of the change. In addition, if during the management review modifications are made to the proposed change, those modifications must also receive a technical review.

Changes to computer software that is used to support safety functions or safety applications must also be considered under the change control process.

Design changes should be subject to the same level of management and technical review as applicable to the original design.

5.3.1 Performing Technical Reviews of Changes

The change control process must contain provisions for a formal, multidisciplinary technical review to be performed for proposed changes to assess the impacts of the proposed changes to the facility, activity, or operation. The technical review must verify that:

- the facility, activity, or operation will continue to operate safely and provide adequate protection to workers, the public, and the environment;
- the contractor's ability to continue to meet safety and environmental requirements, performance criteria, permit requirements, or any other applicable state or Federal requirement is not negatively affected;
- the mission can continue to be achieved;

- the change will not create unacceptable maintenance problems;
- the security of the facility or activity is not compromised; and
- the safety basis is preserved or the changes to the safety basis are assessed and determined to be acceptable.

The technical review includes:

- design basis review
- independent design verification
- interdisciplinary technical reviews
- identification of affected hardware and documents
- identification of post-implementation acceptance criteria
- other reviews, as appropriate

The technical review process is illustrated in Figure 5-2.

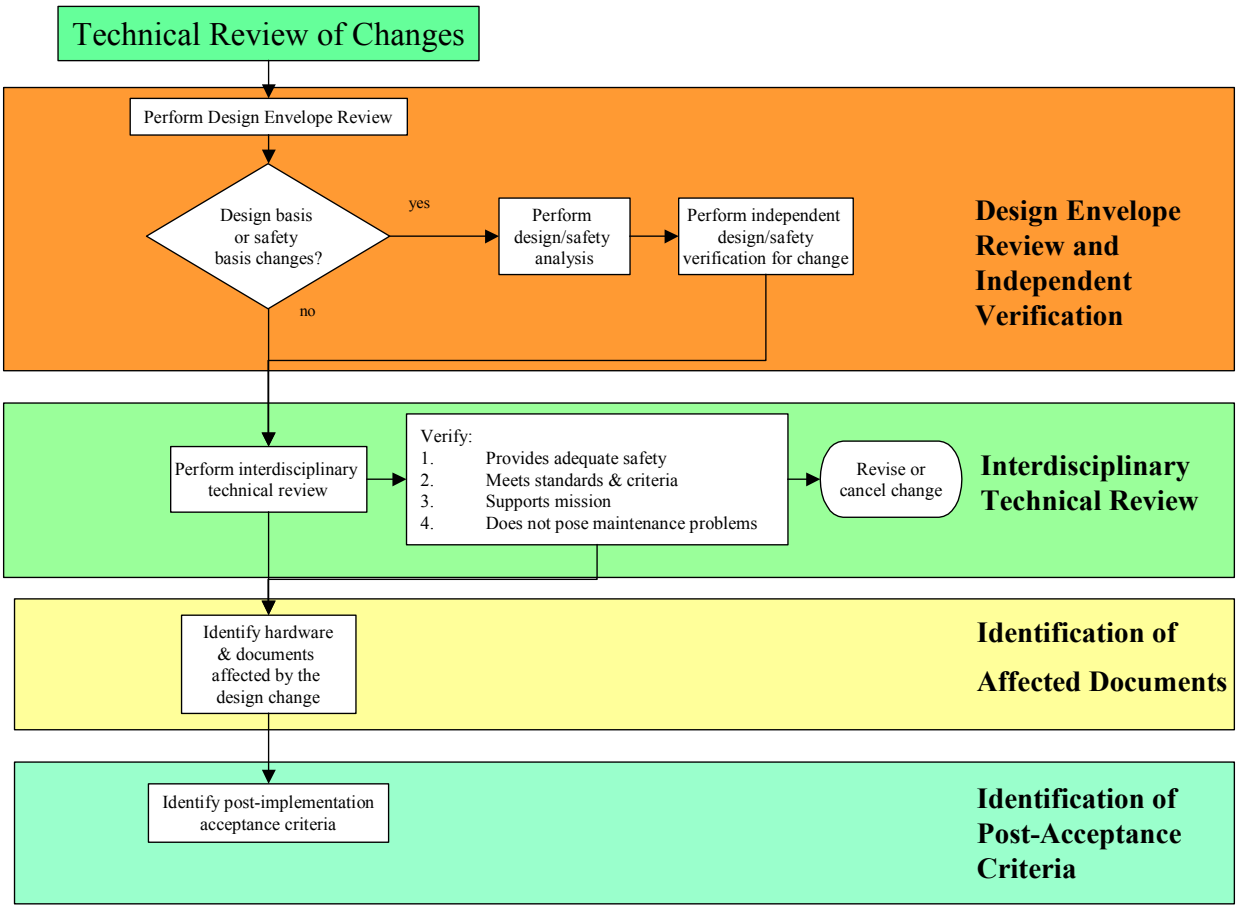

Figure 5-2 Technical Review of Changes

5.3.1.1 Design Basis Review

If the proposed change is not within the current design basis, the contractor must perform a design analysis for the change. The design analysis must be sufficiently detailed that the technical reviewers can assess the adequacy of the analysis. The individuals responsible for the technical review must be provided with the change control package for those reviews. The design analysis should include:

- current and proposed design inputs and constraints,
- an analysis of the proposed changes and their impacts,
- design outputs,
- consideration of systems interactions,
- any assumptions that must be verified in the post-operational testing, and
- identification of any computer program that was used in the analysis.

Changes that affect the design basis require a design analysis by the design authority. The design basis is generally identified by the design requirements in the equipment database or the references listed in the equipment database. Therefore, changes to the design requirements identified in the equipment database will likely require a design analysis.

Examples of changes that would require a design analysis:

- a change that permits an increase in the maximum number of plugged tubes in a heat exchanger beyond that indicated in the equipment database or safety analysis or

- a setpoint change outside the range of acceptable setpoints identified in the equipment database.

Example of a change that does not impact the design basis and generally would not require a design analysis is a change to an equipment setting that continues to be within the range specified in the equipment database (e.g., a pump actuation setpoint that is changed from 60 psig to 62.5 psig when the equipment database indicates the acceptable range is 55 to 65 psig).

A change to the design basis will often involve a revision to the safety basis (DSA and/or the TSRs). Revisions to safety bases involve significant effort by the design authority and include external evaluations and approvals. Typically, changes to safety bases will require USQ reviews. Consequently, the contractor should weigh the resources needed to process the design change against the benefits of the proposed change. Another change that could accomplish the objectives of the original change within the current design basis might be more cost-effective.

If the design requirements for the proposed change are not available in the equipment database, then the design authority may need to recover or generate those requirements before the evaluation can proceed.

5.3.1.2 Independent Design Verifications

The provisions of 10 CFR 830.122(f) (4) require the contractor to use individuals or groups other than those who performed the work to verify or validate the adequacy of any changes to design products. Documentation of the independent design verification must be included in the change control package. The independent design verification must verify that:

- design inputs and constraints are correctly identified;
- design analyses and calculations are complete and correct;
- design outputs are complete and consistent;
- the reasonable methods are used in the analysis and, where applicable, computer programs are verified;
- system interactions are considered appropriately;
- the assumptions are reasonable; and
- appropriate post-modification testing and acceptance criteria are established.

5.3.1.3 Interdisciplinary Technical Reviews

Unless the contractor determines that the proposed change does not need to be reviewed through the change control process, the contractor must perform an interdisciplinary technical review before proceeding with the proposed change. The technical review should involve all potentially affected disciplines and organizations such as design, operations, maintenance, training, radiation protection, fire protection, and security. Often a change that does not appear to be significant can be assessed to have an impact to another discipline. For example, the temporary removal of a door to facilitate a maintenance activity could impact security or fire protection.

A change to a component also may impact system performance. Consequently, a Cognizant System Engineer should be engaged in the review process. A change to a component or system may impact nearby or interconnected components or systems. This potential should be assessed in the review. The Cognizant System Engineers for nearby or interfacing systems should be consulted as appropriate.

The technical review team must be aware of the potential impact of the change on safety and reliability, as well as the design requirements. One of the challenges of change control is to be cognizant of many ongoing changes—from proposal, through development, to implementation—and to understand the integrated effect of the various changes. The Cognizant System Engineer concept has been used in the commercial nuclear industry to provide a technical focal point for each system. The Cognizant

System Engineer develops resident technical expertise and facility knowledge, centralizes resolution of SSC performance problems for more timely and effective response, and interfaces between the facility operations and maintenance organizations and the design engineering organization. The Cognizant System Engineer concept benefits configuration management as well as many other facility activities including facility status and troubleshooting, operations support, coordination of testing and other system-related activities, and communication among departments.

As discussed in Chapter 3 of this standard, DOE O 420.1A, *Facility Safety*, requires contractors to designate a Cognizant System Engineer for each system for DOE Category 1, 2, or 3 nuclear facilities. The duties, responsibilities, and interfaces of each Cognizant System Engineer need to be clearly defined, documented, communicated to and understood by supporting facility organizations. To facilitate the change control process, each Cognizant System Engineer should perform the following functions:

- monitor and track the status of the assigned system, especially during changes (e.g., physical changes in progress and temporary physical changes);
- conduct and/or observe equipment performance monitoring, evaluating the results of performance monitoring and surveillance, trending important data, and initiating corrective actions;
- review and approve post-modification, post-maintenance, surveillance, and special test procedures and test results;
- provide assistance to operations and maintenance, as needed; and
- identify any situation where the design engineering organization should be consulted for advice or services.

Finally, the technical review team must include someone who has demonstrated competence in the area of the change and who understands the design and system requirements and functions.

Reviewers may meet to consider the change concurrently or they may be sent the proposed change to review and provide comments or approval to a central coordinator. If a change is made to the proposal as a result of either the technical or management review, the reviewers should be given an opportunity to review the change and reaffirm or retract their approval of the proposed change. Some DOE sites and facilities use Change Control Boards (CCBs) to conduct all or part of the technical evaluation of changes.

5.3.1.4 Identification of Affected Documents

Once it is determined that a proposed change can be made, either within the defined design requirements or within new or revised design requirements, each affected document must be identified. This includes the documents that are directly affected by the change, such as drawings, as well as indirectly affected documents such as the DSA, hazard controls, training information, procedures, and systems drawings.

A complete and thorough review must be done to identify each affected item. If other SSCs are affected by the change, the contractor must determine if documentation for the affected SSCs also needs to be changed. Examples of documents that are sometimes overlooked are configuration management databases, operating and maintenance procedures, and training lesson plans. The configuration management equipment database and the document database should be used as primary tools to identify affected documents. Cross-disciplinary and cross-organizational reviews may be necessary to identify all affected documents. The document control process is addressed in greater detail in Chapter 6.

5.3.1.5 Identification of Post-Implementation Acceptance Criteria

As part of the design review, contractors should define the post-implementation (or post-modification for physical changes) test methods and acceptance criteria. All post-implementation testing should be completed and all acceptance criteria satisfied prior to turnover to operations, unless specific tests are to be done post-turnover.

5.3.2 Performing Management Reviews of Changes

5.3.2.1 Management Verifications

Following the technical review, contractor management must review the proposed change to verify that:

- the technical review was adequately performed,
- the change control package is complete and ready for implementation,
- any necessary external reviews and approvals have been obtained, and
- funding is expected to be available to complete the implementation and update the documentation.

The management review may also consider:

- whether the change is necessary,
- whether the benefits of the change warrant the cost and schedule impacts,
- the source of funding to complete the change, and
- whether management approval should be based on other criteria.

In some cases, it may be possible to perform the technical review and the management review concurrently. However, in such cases, the contractor must ensure that both sets of responsibilities are sufficiently executed.

5.3.2.2 Appropriate Levels of Management Review

The configuration management process should specify the expectations for a management review of proposed changes. The configuration management process may specify different levels of management review for changes based on a documented graded approach. The managers at the lowest authorized level should normally perform the management review, in order to reduce the time needed to process the proposed change. However, it is important that the appropriate level of management in affected organizations are aware of pending changes and are actively involved in their review and approval. Consequently, it may be advantageous in some situations to elevate the management review to a higher level of management to facilitate implementation of the change when it is approved.

5.3.2.3 Clear Documentation

Change control packages must be provided for the management review. The packages should be complete and easy to use and understand.

5.3.3 Performing USQ Reviews

The USQ process was established to allow contractors to make changes without prior approval from DOE, provided those changes do not explicitly or implicitly affect the safety basis of the facility or activity. The configuration management process should specifically state that the DOE-approved USQ procedure must be consulted for all proposed changes and implemented whenever required by the 10 CFR Part 830 or the DOE-approved USQ process. If the USQ review determines that the change involves a USQ, then DOE approval is required before implementing the change. Additional guidance on the USQ process can be found in DOE G 424.1-1.

5.3.4 Performing Other Reviews

In addition to the design, management, and USQ reviews, the following reviews should be considered and performed, where appropriate:

- peer review
- cost and benefit review
- maintenance and reliability review
- review of the impact on the operations schedule
- reviews required by regulatory or contract requirements.
- facility walkdown (a sample procedure for conducting a walkdown is provided in Appendix G).

5.4 Approving Changes

The configuration management process should define the approval authority for a change. The approval authority for various changes may vary based in the significance of the change.

5.5 Implementing Changes

5.5.1 Performing Work

Changes must be reviewed, approved, verified, and validated before they are implemented. They must be implemented consistent with the approved change control package. Work must be performed consistent with hazard controls and using approved instructions, procedures, or other appropriate means.

5.5.2 Developing Change Control Packages.

The contractor should (1) document each step of the change control process (i.e., identification, reviews, approvals, implementation, and document updates) and (2) track the implementation in the change control package. Documenting and tracking are essential to ensure that each change is fully assessed, approved, and implemented in accordance with the approved change, and that the affected documentation is identified, updated, and distributed to controlled users. The change control package should be used to capture the change request, the various technical reviews and evaluations, the management review, and the implementation results. The contractor must also include related information (such as the change request, design package, installation package and, post-modification testing) in the change control package. The change control package should be kept in one location until installation is complete.

The change control package should be used to track the changes to completion. Prior to implementation of the changes, the change control package should be reviewed to ensure that:

- it is complete and usable,
- there are no unidentified physical interferences,
- the change is likely to meet defined post-implementation acceptance criteria, and
- the change has been approved for implementation.

The change control package should:

- identify all deviations from current design requirements so that the changes are tracked and documented,

- identify all documents that need to be revised consistent with the approved change,
- define the authorities and responsibilities associated with the approved change,
- identify the work processes to be used to implement the change, and
- identify any constraints to the implementation process.

An individual or group other than the one that developed the package must perform the review of the change control package. A modification or construction package may be used to further define implementation instructions.

5.5.3 Deviating from or Making Changes to the Change Control Package.

Changes should be implemented consistent with the change control package. The design authority must identify, review, and approve any deviations from, or changes to, the change control package prior to implementation. Contractor procedures must define this process (often called field change requests or FCRs) and the authority levels. FCRs should receive technical and management reviews commensurate with those of the original package and the approval authority level should be at the same level as the original change. Following evaluation and approval by the design authority, field change notices (FCNs) should be issued that revise the work processes consistent with the approved change.

In addition, if the contractor identifies any nonconforming items while implementing a change, the contractor should document the nonconformance in a nonconformance report (NCR). The NCR should be reviewed to verify that it:

(1) meets design criteria and assumptions and
(2) is consistent with the analyses.

The review and disposition of NCRs must be documented and retained.

5.5.4 Tracking Changes to Completion

Consideration should be given to assigning an individual the responsibility for tracking physical change status and ensuring that the change is completed in accordance with the change control package. Contractors have successfully used Cognizant System Engineers or dedicated configuration management specialists to perform this function.

5.5.5 Reporting Implementation Progress

The contractor should consider issuing periodic progress reports on the implementation of major changes. These reports should:

- identify the approved change,
- list the systems, and major SSCs affected by the change,
- identify any impacts or constraints on current operations,
- identify and deviations or waivers that have been approved to originally approved change,
- provide a status report on the implementation and verification of the changes.

5.5.6 Paying Attention to Partially Implemented Changes

The contractor should pay special attention to partially implemented changes. Failure to identify and take the proper precautions for partially implemented changes can lead to the premature closure of a modification package, operation in an unanalyzed condition, and/or documentation that is inconsistent with the actual configuration.

Two types of partially implemented changes can occur:

- staged implementation, where availability of time, money, or equipment dictates that the modification has to be planned and implemented in a staged manner or
- interrupted implementation, where the implementation could not be completed as planned for any of a variety of reasons.

DOE O 5480.19 defines requirements for conduct of operation, including temporary modification control. It states:

> Administrative control systems should be established for installation of temporary modifications such as electrical jumpers, lifted leads, pulled circuit boards, disabled annunciators/alarms, mechanical jumpers/bypasses, temporary setpoint changes, installed or blocked flanges, disabled relief or safety valves, installed or removed filters or strainers, plugged floor drains, and temporary pipe supports. Prior to modification, these controls should provide for communicating the installation of temporary modifications to the design authority to allow for technical oversight and an evaluation of the impact on current design activities, and approval of the design modification. These control systems should make provisions for safety reviews, installation approval, independent verification of correct installation and removal, documentation of the modification, update of operating procedures and documents, training, marking of installed modifications, and the periodic audits of outstanding modifications.

In addition, DOE O 5480.19 contains additional instructions related to control of equipment status, lockouts and tagouts, and other areas associated with conduct of operations applicable to partially implemented changes.

5.5.6.1 Design Analysis for Partially Implemented Changes

The change control package for a staged implementation should identify the various stages of implementation and provide an analysis of the operation at each stage. For

interrupted implementation, an analysis should be developed and reviewed and approved by the design authority as soon as possible after the interruption is identified.

5.5.6.2 Operation with Partially Implemented Changes

The design authority must approve partially implemented changes prior to operation. Documents should be updated and distributed for partial implementation consistent with the process for documents for uninterrupted implementation. The design engineering review should confirm that the original technical review is still valid or indicate that a new technical review is completed and approved.

5.5.6.3 USQ Reviews for Partially Implemented Changes

The contractor should determine if a USQ review is needed prior to operation in the interrupted condition. The contractor must use the requirements of 10 CFR 830.203 and the DOE-approved USQ procedures to determine if a USQ review is required.

5.5.7 Implementing Multiple Changes in Parallel

Another area where the contractor must pay particular attention is the parallel implementation of two or more changes that affect or involve the same structure, system, or component. In such cases, a single person, such as the Cognizant System Engineer, should be assigned to oversee the implementation of all changes being made to the system, structure, or component. In addition, the change control packages should note any parallel changes that are being made to the system, structure, or component and any restrictions or limitations on the order of activities from the multiple changes. The individual assigned to oversee the multiple changes should also sign all field change notices for any of the parallel changes.

The design analysis for the change must consider any parallel changes and the level of completion of the change prior to return to operation of the system, structure, or component.

5.6 Post-Modification Testing

The quality assurance provisions of 10 CFR 830.122 require contractors to validate work before implementation and perform acceptance testing. The change control package should specify the post-modification testing to be performed and the acceptance criteria. Post-modification testing validates that the system or component performs as intended and operates within the design requirements after the change is installed and before turnover to operations. These tests serve as the final and independent check of the adequacy of the design review for the proposed change.

5.7 Post-Modification Training

Criterion 2 of 10 CFR 830.122 (b) requires contractors to train and qualify personnel to be capable of performing their assigned work and to provide continuing training to personnel to maintain their job proficiency. Before returning a system, structure or component to service following changes, the contractor must train staff on the modifications that have been made and their affect on normal, abnormal, and emergency operations.

5.8 Documentation Changes

Because every change directly or indirectly affects associated documentation, a major interface exists between the change control and document control processes. Drawings and procedures will need to be updated as part of the work processes to implement the change. Other documents will need to be updated and issued as "as-built" documents following implementation. All affected documents must be identified as part of the design review of changes and identified in the change control package. The affected documents should be updated in a timely manner.

5.8.1 Updating Critical Documents Before Implementing Changes

Critical facility documents, such as drawings and procedures needed for operation, must be updated prior to placing systems and components in operation.

5.8.2 Providing As-built Documentation

As-built documentation should be prepared at the completion of implementation of the physical changes. Revised documentation should be distributed to users of controlled documents. Maintenance of documents and records is required by the quality assurance requirements in 10 CFR 830.122(d). Additional information on document control is provided in Chapter 6 of this standard.

5.9 *Grading Change Control*

The contractor's configuration management process may enhance or limit the degree or rigor and detail of the review and approval of the change depending upon the importance of the SSCs involved. For example, safety SSCs may warrant a higher level of approval than defense-in-depth SSCs not designated safety SSCs. The approval levels and other grading of the change control process must be documented in the configuration management plan.

5.10 Improvement

If a significant change needs to be made to the facility or activity because of a deficiency in the design process, the design process should be reviewed and corrected to prevent reoccurrence of the problem.

5.11 Baseline Change Control

Contractors should refer to their contracts and Chapter II of DOE O 413.3 for possible requirements related to changes to project and capital assets.

6 DOCUMENT CONTROL

Document control ensures that only the most recently approved versions of documents are used in the process of operating, maintaining, and modifying the nuclear facility. Document control helps ensure that:

- important facility documents are properly stored;
- revisions to documents are controlled, tracked, and completed in a timely manner;
- revised documents are formally distributed to designated users; and
- information concerning pending revisions is made available.

As controlled documents are updated to reflect changes to the requirements and/or physical installation, the contractor must ensure that:

1) Each updated document is uniquely identified and includes a revision number and date and

2) Each outdated document is replaced by the latest revision.

A diagram of the features of document control functions is provided in Figure 6-1.

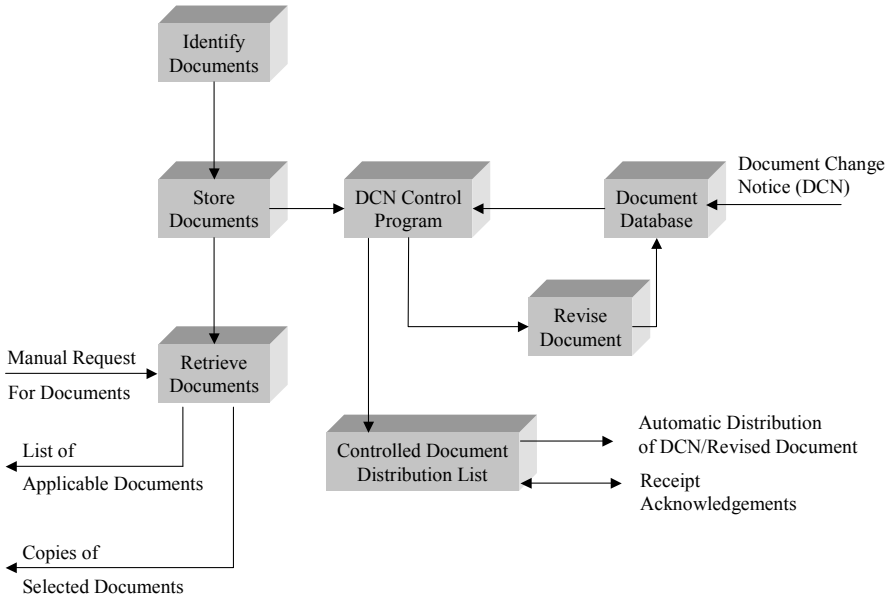

FIGURE 6-1 DOCUMENT CONTROL FUNCTIONS

6.1 Identifying Documents to be Controlled

Contractors must determine what documents need to be controlled. They also must define "document owners" who are responsible for developing and revising the technical content of the documents and ensuring they are maintained current. Document owners will also establish the schedules for document revisions, distribution, and retrieval.

Documents to be controlled should include those documents that reflect the facility's requirements, performance criteria, and associated design bases. However, the number of documents that must be controlled should be limited because of the resources required to properly control documents.

DSAs, the TSRs, the documented design requirements, the safety management plans, and any other documents that are referenced by, or support, the DSAs should be controlled documents. Contractors should assess controlled documents to determine if they need to be updated whenever changes are made to the facility or activity configuration, the design requirements, or other documentation that might impact them. Typical controlled documents include:

- DSAs;
- Authorization Agreements and associated references;
- Safety Management Plans;
- hazard controls, including TSRs;
- documents that identify or define design requirements;
- design specification and calculations;
- accident analyses;
- software data and manuals for operation and maintenance of critical software;
- key procedures;
- key drawings; and
- key vendor supplied documents.

SDDs and other similar documents may contain specific information about preventive and mitigative SSCs that is too detailed to include in the DSA, but which facility personnel need to understand design, operation, and maintenance of the facility, activity, or operation. Whenever a change is initiated, the contractor should also review the applicable SDDs to determine if they need to be updated. The SDDs typically include

- detailed design and operating descriptions;
- diagrams, such as electrical schematics and piping and instrumentation diagrams; and
- load lists.

After identifying which specific documents need to be controlled, the following information on each document should be recorded in the document databases to facilitate tracking and control:

- document type,
- unique document number (document control number),
- document uses and priority,
- document owner,
- revision level,
- current status (approved, draft, cancelled, superseded, etc.),
- information regarding pending changes, and
- other information needed for control and tracking, such as location and outstanding Document Change Notices (DCNs).

This information should be retained in an easily retrievable manner. Selected document information should also be entered into the configuration management equipment database to establish a cross-reference or link between configuration management systems and components and the associated documents.

As new documents are generated, they should be reviewed for inclusion in the controlled document database. One factor to consider in determining if a document should be controlled is whether the new document supports a CM SSC. The appropriate data on the document should be entered into the controlled document database with the appropriate data fields completed. The completeness and accuracy of the controlled document database is essential to the control and tracking and the retrieval functions of document control.

In order to ensure that the efforts and resources of document control are appropriately focused, contractors should review the list of controlled documents periodically and strive to consolidate and reduce the volume of controlled documents.

6.2 Storing Documents

The objective of temporary and long-term storage facilities for documents is to preclude damage or loss from deterioration, larceny, or vandalism. The methods of storage should be based on the particular characteristics of the document. Special consideration should be given to light-, pressure-, or temperature-sensitive documents (e.g., radiographs, photographs, film) consistent with applicable industry standards. Contractors should assign specific individuals the responsibility to ensure those records (active and inactive) and other documents are protected, preserved, and stored such that they can be retrieved within defined retrieval times. A central document control organization may be assigned these storage responsibilities.

Storage and retention of documents must meet government record keeping requirements. They should also meet applicable DOE Orders, specific commitments to DOE, national standards, and the needs of the document owners and users. Originals or master copies of controlled documents should be stored and protected. Retention times should be established to meet the needs of the document owners and users and adhere to Federal record keeping requirements. Document control procedures should establish requirements for regularly backing up electronically stored documents on a defined schedule.

6.3 Controlling and Tracking Documents

Contractors must control select documents to ensure that only the currently approved revisions of the documents are used. Contractors must track information on documents to ensure the current status of documents is reflected and information is available on pending changes. The major features for the effective control and tracking of documents are discussed below.

6.3.1 Control Procedures

Contractors should develop and implement procedures that specify the document identification, control, storage, and retrieval requirements. These procedures should establish responsibilities and methods for each document control function. They should also include provisions for the review of controlled documents to ensure they are complete and approved prior to distribution. Document change notices should be used to notify users of document changes.

6.3.2 Secure File

Contractors should establish and maintain a secure master file of the original documents or master copies. The master copies should not be released from that file; only reproductions should be provided, either on a regular distribution schedule or in response to specific requests. Contractors should establish:

- strict controls for the viewing of master copies and
- access and security precautions to ensure that the document master file is controlled and kept current.

Alternatively, the documents may be stored electronically and made available through the web. Appropriate controls must be established to ensure that:

- the document files are backed up
- they are not lost and
- the latest version is available on the web and postings do not lag behind changes.

6.3.3 Controlled Document Distribution List

Contractors should establish and maintain controlled document distribution lists. The lists should identify both the documents that are to be controlled and the individuals who are holders of copies of those documents ("controlled document users," or as identified in 10 CFR Part 830, Appendix A, paragraph G.5, the "authorized users list"). The document owner should determine the list of controlled document users to be included on the controlled document list. The distribution list should include any satellite document distribution centers. To ensure they are included on the distribution list for revised documents, controlled document users should inform the document owners of their need for specific documents. Whenever a document is superseded by a new revision, a copy of the new revision must be sent to each controlled document user of the document.

6.3.4 Identification of Proposed Changes

The organization responsible for document control should be notified of any need to change a document as soon as that need is identified and approved, typically through the change control or work control processes. A DCN may be used for this purpose. The organization responsible for document control should provide a receipt acknowledging the notification that a document should be changed. The organization responsible for document control should take the appropriate action to update the document and record the status in the document control database.

6.3.5 Major Vs. Minor Document Changes

The contractor should specifically identify in the change control process what constitutes a minor change (e.g., inconsequential, editorial corrections). Major changes to controlled documents are any changes that are not defined as minor changes. Major changes to controlled documents must be reviewed and approved by the document owners. The configuration management process may specify a simpler review for minor changes.

6.3.6 Notification of Pending Changes

Pending changes are changes that have been approved for which the associated documents have not yet been updated and distributed. The organization responsible for document control should provide notice of pending changes to the controlled document users for the applicable documents. A notice of the pending change should also be attached to, or appropriately referenced on, the affected master document, in order to alert anyone requesting a copy of the document.

6.3.7 Timely Incorporation of Changes

Contractors must incorporate approved changes into controlled documents in a timely manner. The contractor should control and limit the backlog of changes that have not been incorporated. Contractors should consider incorporating small changes in batches, where appropriate. When there is a large backlog of changes that have not been incorporated on a document, the documents may not reflect the physical facility or the approved safety basis consequently diminishing the value of the documents. Document control procedures should specify the limit of the number of changes that may be outstanding for a document before the document is revised. That limit may vary depending upon the type of document, document priority, complexity of the changes, and the degree of overlap of those changes.

6.3.8 Distribution of Documents

Whenever a document is issued or superseded by a new revision, the contractor organization responsible for document control must send a copy of the new revision to each controlled document user of the document, along with a request for written receipt acknowledgment. Contractors can facilitate the return of receipt acknowledgments by sending a receipt acknowledgment form with the revised document. Document control procedures should specify guidelines for the maximum time between issuance of the revised controlled document and distribution. For example:

Level of importance of controlled documents…	**Maximum time before distribution…**
Most important (e.g. TSRs)	24 hours
Important	72 hours
Least important	7 days

The recipients (controlled document users) should update their copy of the document (for example, by inserting changed pages), and discard any obsolete pages or copies of documents. The recipient must return a written acknowledgment of receipt to the document control organization. The controlled document users should periodically review controlled copies in use to ensure their accuracy and their consistency with the master copies.

6.3.9 Control of Superseded or Canceled Documents

The contractor should ensure that the document control process includes measures to ensure that superseded or canceled documents are replaced. If someone requests a copy of a superseded or canceled document, the provider should clearly and distinctively mark the document as "Superseded" or "Canceled" before providing the document.

6.3.10 Document Database

The document control process should include a database for tracking document status and pending changes. The contractor must assign a database owner for the document database with assigned roles and responsibilities. The database should contain basic information about the document, including:

- the unique document identification number,
- the document owner,
- the document type,
- the current revision number,
- the current document status (e.g., in revision, recently revised, needs to be revised),
- information regarding pending changes,
- outstanding document change notices, and
- any other information necessary for control and tracking.

As discussed below, the document database also supports the document retrieval function with associated information such as retention times, storage location, retrievability guidelines, and key words.

6.4 Retrieving Documents

Contractors should ensure that documents are retrieved (made available) in a timely manner upon request. The contractor should establish the maximum retrieval time for each document based upon priorities provided by the document owners and users. Easy retrieval of documents is a service that facilitates contractor activities and encourages workers to use up-to-date information.

When a copy of a document is issued, it should be the most recent version. The contractor should make the status of controlled documents available to the affected organizations. Additionally, the organization responsible for document control should supply information regarding pending changes, including references to detailed information, to anyone requesting the latest copy of the document. For example, if a drawing is requested, the document control organization should also provide the requester with a list or copies of existing change information (e.g., outstanding document change notices, pending changes, and related physical changes in progress). This will alert the requester to upcoming changes that could affect the retrieved document.

There are numerous document identification systems available, each possessing unique advantages and disadvantages. Document identification systems range from the simple, manual control of hard copies to elaborate computer-based, keyword-searchable, full-text databases linked to the document images. Variables that affect the type and degree of sophistication of the document identification systems selected include the size of the

facility, the volume of documents, available resources, existing programs, and the retrieval requirements of the users of these documents. The document database selected needs to provide the capability to support identification of relevant documents.

The document database should have the capability to sort and identify documents based on:

- their relationship to particular systems and components (such as a particular pump),
- types of systems and components (such as motor-operated valves),
- technical topics (such as fire protection), and
- other relational data (such as the specific vendor) necessary for the adequate identification of documents.

Furthermore, when the document or document sets are provided, the system should also provide related information, such as the identification of pending changes. Consideration should be given to assigning key words or using fully searchable text files for the most important documents.

In selecting the appropriate document information system, the contractor should ensure that the system is available and documents can be retrieved as needed to support document owners and users. If the documents are necessary for the day-to-day operation of the facility, they should be available on a real-time or short-turnaround basis [e.g., controlled copies of procedures and piping and instrument drawings (P&IDs) should be located or accessible in a central area such as a control room]. Conversely, if the documents are not routinely needed, a retrieval time of 24 hours or more may be acceptable. This is typical, for example, of design basis information used by the design engineering organization for physical change preparation. In order to establish appropriate retrieval times the contractor may need to formally solicit and consider input from the document owners and the users.

6.5 Controlling Interfaces

The contractor should clearly define the interfaces among facility, maintenance, and non-facility organizations to ensure configuration-related information is completely and accurately communicated. For example, a change to a vendor manual may result in changes to maintenance procedures, training materials, equipment lists, repair parts, and design basis documents such as specifications and drawings. In addition, information may flow in both directions across organizational interfaces. For example, information related to a design change may be needed by operations, maintenance, and/or training to update procedures to conform to the facility requirements. Conversely a procedure change initiated by maintenance personnel that affects an operating parameter may necessitate validation by design engineering personnel to verify expected operating conditions fall within the requirements. The configuration management process should establish controls to ensure:

- necessary information that initiates a configuration change is sent to all affected organizations and
- the appropriate reviews, actions, and document updates are accomplished in a timely manner.

6.6 Controlling the Preliminary Documented Safety Analysis

Following submittal of the preliminary documented safety analysis (PDSA) to DOE, the contractor must review all changes for their potential impact on the PDSA and maintain the PDSA up-to-date as the design evolves so that both the contractor and DOE can rely on the information until it is replaced by the final DSA.

7 ASSESSMENT

The quality assurance criteria of 10 CFR Part 830, Subpart A, require DOE contractors for nuclear facilities (including activities and operations) to assess management processes and measure the adequacy of work performance. Furthermore, the assessment criteria require that the persons performing the assessments:

- have sufficient authority and freedom from line management and
- are qualified to perform the assessments.

The maintenance criteria of DOE O 433.1 also require periodic assessments to verify the condition of systems and equipment.

This chapter discusses four different types of assessments that can be performed to determine the effectiveness of different aspects of the configuration management process (see section 7.1). Periodic assessments help ensure that work processes continue to function properly or problems are identified, root causes are determined, and problems are corrected. This chapter provides guidance on performing assessments directly related to configuration management. While contractors may perform these assessments of the configuration management process separate from other assessments, it may be more efficient to combine these assessments with other periodic assessments of the activity. All or part of the assessment of the adequacy of configuration management for an activity may be integrated into broader management and performance assessments, such as quality assurance, maintenance, or integrated safety management assessments. If the contractor decides to fold the assessment of configuration management into a broader assessment, it must consider the criteria in this chapter when developing the assessment criteria for the broader assessment.

7.1 Assessment Objectives

The objective of assessing configuration management is to detect, document, determine the cause of, and initiate correction of inconsistencies among design requirements, documentation, and physical configuration. Properly performed assessments should help identify inconsistencies between these areas, evaluate the root causes for these problems, and prescribe improvements to avoid similar inconsistencies in the future.

The five specific types of assessments discussed in this chapter are:

- Construction assessments, which are performed to ensure configuration is managed throughout the construction process for new construction or major modifications.

- Physical configuration assessments, which are conducted to evaluate the consistency between the physical configuration and the facility documentation.

- Design assessments, which are done to ensure that design documents have been updated to reflect changes and accurately reflect the physical configuration of the nuclear facility.

- Post-construction, -modification, or -installation inspections and tests, which are performed either after construction, modification, or installation to verify operation is as expected.

- Periodic performance assessments, which are conducted to verify that systems and components continue to meet design and performance requirements in their current configurations.

7.2 Construction Assessments

Because of the changing nature of the physical configuration of a facility under construction, the contractor may not impose a rigid change control process in early construction. As stated in paragraph 3.1.1, DOE and the contractor must formally agree on the point when the configuration management process will be imposed and what process will be used. There should be a documented plan for configuration management during construction. It may be appropriate to use different processes as construction proceeds and the physical configuration approaches completion. Construction inspections/audits are performed throughout the construction process for new construction or major modifications, to ensure the quality of the construction and the conformance to design specifications. Adherence to the applicable configuration management process should be a part of the construction assessment process. In particular, the physical configuration should be assessed at construction turnover to ensure that the physical configuration is consistent with the design requirements and the documentation, including (but not limited to) as-built drawings. Construction assessments may involve physical configuration assessments; design assessments; post-construction, -modification, or -installation inspections and tests; and/or periodic performance assessments.

7.3 Physical Configuration Assessments

Physical configuration assessments are performed to determine if the actual physical configuration agrees with the design requirements and the documentation. They also determine the effectiveness of configuration management in the field. Information is gathered through interviews with knowledgeable facility personnel, document reviews, and detailed walkdowns and observations of the actual facility configuration.

As specified in DOE O 420.1A, *Facility Safety*, these assessments should be conducted as part of the review of system operability, reliability, and material condition during facility inspections required by DOE O 433.1, *Maintenance Management Program for DOE Nuclear Facilities*. These periodic reviews assess the system's ability to perform its design and safety functions. In addition, these assessments should integrate with the activities performed to meet the Quality Assurance Program (QAP) under 10 CFR Part 830, Subpart A. As stated in DOE O 433.1, the goal of the assessment process should be to ensure the integrity of the identified SSCs. Contractors must analyze discrepancies and take appropriate corrective action to resolve them. If substantive discrepancies (either in number or type) are discovered, the contractor must develop appropriate immediate corrective actions to establish agreement between the physical configuration and the documentation. Corrective actions should include technical evaluations, based on system requirements, to determine whether the physical configuration or the documentation should be changed. For existing facilities, the corrective actions should include additional walkdowns to characterize the problem and to determine the extent of the problem.

Physical configuration assessments should be conducted at a specified periodicity to establish confidence. Contractors should routinely review the configuration of those systems performing vital safety functions (safety SSCs). Additional systems of lesser importance should be included at a lesser periodicity to ensure the breadth of the configuration is being maintained adequately. Special reviews may be required on an as needed basis, such as to verify input into a new DSA or when unusual or off-normal occurrences affecting the safety basis systems results in a lack of confidence in the facility configuration or in a concern that it has been compromised. Contractors should consider scheduling reviews of the configuration of safety SSCs on an annual basis on a schedule appropriate to support the annual update of the DSA.

Physical configuration assessments may be performed on a sample basis, with the sample providing a representative cross-section of component types within the system being assessed. The sample should be large enough to ensure that a statistically significant portion of the system and its components are chosen. For instance, the sample should include major and minor components, large and small bore piping (where applicable), and instruments and controls.

Two common types of physical configuration assessments are "walkdowns" and resolution of configuration and documentation discrepancies. While the processes of walkdowns and resolution of configuration and documentation discrepancies have significant overlaps, the distinctions between them need to be understood. One distinction is based on the products of these processes. A product of the walkdown process is a set of marked-up documents that reflect the actual physical configuration and identify discrepancies with the currently approved facility documentation. A product of the resolution of configuration and documentation discrepancies is "as-built documents" that have been field-verified and design-verified.

7.3.1 Walkdowns

During walkdowns, the as-found configuration is identified by comparing the existing physical configuration with the facility documentation to identify any discrepancies, typically by marking up the documents. Walkdowns are sometimes conducted to:

- Record manufacturers' nameplate data from equipment,
- Identify missing or incorrect equipment labeling,
- Determine the present material condition of equipment, and
- Identify potential physical interactions between equipment (such as non-seismically qualified equipment mounted in such a position as to impact seismically qualified equipment during an earthquake).

A sample walkdown procedure is provided in Appendix G.

7.3.2 Resolution of Configuration and Documentation Discrepancies

The resolution of configuration and documentation discrepancies involves:

- determining the actual physical configuration that exists at a point in time,
- identifying any discrepancies with the facility documentation, and
- technically resolving those discrepancies.

In some cases, discrepancies arise simply because the facility documentation is incomplete or inaccurate in some detail. In other cases, discrepancies arise because inadequately controlled hardware changes caused the physical configuration to become different from the facility documentation. The level of detail of a particular facility document type establishes the threshold of the corrections that need to be made. If a facility document provides, or is intended to provide, information that does not agree with the actual physical configuration, those discrepancies should be identified and resolved. Leaving incorrect or unverified information on a document is likely to mislead users of the document. Further, any information that is left on as-found documents and has not been verified should be clearly identified. If the contractor is made aware of an as-found discrepancy, the contractor should perform a technical review to determine if the physical configuration is the desired configuration (in accordance with design requirements) or if the facility documentation indicates the appropriate configuration (the physical configuration needs to be changed to meet design requirements). In some cases, the resolution of a discrepancy might be to establish the acceptability of the existing physical configuration and change the design requirements. The design authority should approve the discrepancy resolution (i.e., design verification) to ensure that the final configuration is consistent with the design requirements. Changes to either the physical configuration or the documentation should be tracked through a design change document. The end product of the resolution of configuration and documentation discrepancies is

documentation that has been both field-verified and design-verified to be consistent with the "as-built" or actual physical configuration.

7.4 Design Assessments

Contractors should perform design assessments to determine the consistency among the documented design and system requirements, the system documentation (including drawings and procedures), and the physical configuration of the nuclear facility. The audit should confirm the completeness and accuracy of the design and system requirements documented in the DSA, the TSRs, and other authorization basis documents. In particular, during these audits the contractor should verify that the safety basis and authorization basis documents accurately reflect any modifications made to the facility or changes made to the activity since the previous design assessment.

One reason for ensuring that the documented design and system requirements continue to be accurate is to provide accurate information for operations, training, and maintenance documents and activities. Contractors should also ensure that operations, training, and maintenance documents are maintained consistent with the documented design and system requirements.

Ideally, contractors should schedule the design assessments at a time appropriate to support the annual update of the safety basis.

7.5 Post-Construction/ -Modification/ -Installation Assessments

Following completion of construction, modification, or installation, the contractor should perform inspections and tests to verify expected operation. Section 4.5.1.2 of DOE O 420.1A requires contractors to test systems following modifications to ensure that they continue to be capable of fulfilling system requirements. These inspections and tests ensure that the system, structure, or component is installed as documented, meets the design requirements, and is verified to be operable prior to being placed into service initially or returned to service. This function prevents unintended changes from being introduced through errors during design or construction. For physical changes, these inspections and tests serve as a final and independent adequacy check of the design and technical reviews for the change. If a changed SSC fails to meet its acceptance criteria, it should not be turned over for normal operations until either a technical review has been completed and any follow-up actions completed or the SSC is returned to its original condition and tested satisfactorily. For the post-modification tests to be effective test conditions should be consistent with normal and emergency operating conditions and acceptance criteria should demonstrate that the applicable design requirements are met. It is important to verify that inadvertent changes were not introduced during a modification. Depending on the extent and complexity of a modification, and the degree of work control, the contractor may need to perform inspections and tests on portions of the nuclear facility that were not modified to properly verify the expected operation after a modification.

7.6 Periodic Performance Assessments

As required by DOE O 433.1*, Maintenance Management Program for DOE Nuclear Facilities*, systems, and components within the configuration management process must be monitored and tested periodically to determine if they are still capable of meeting their design and performance requirements. The process for performing this monitoring and testing should be described in the Maintenance Implementation Plan (MIP) required by DOE O 433.1. DOE G 433.1-1, *Nuclear Facility Maintenance Management Program Guide for Use with DOE O 433.1*, provides information useful for developing and implementing this monitoring program. Monitoring and testing may take the form of surveillance actions, periodic in-service inspections and tests, and other monitoring of systems and components to ensure safe and reliable operation of the facility. In addition to observing direct results, derived results may include reliability assessment, performance trending, and equipment aging characteristics. Contractors should use the results of this monitoring to identify and avoid inconsistencies between functional and performance requirements identified in the design and actual capability of systems and components. In addition, contractors should use trending of data to detect degradation of equipment due to aging or other causes.

By performing periodic performance monitoring, contractors should verify that selected systems and components continue to be able to perform their intended functions (i.e., meet their design requirements). Contractors should correct any deficiencies identified

during the periodic performance assessments that cause the systems or components to deviate from design requirements (see 10 CFR 830.122(c)(2)). Contractors should also identify any root causes of performance degradation (see 10 CFR 830.122(c) (3)). Contractors should routinely monitor, collect, trend, and analyze performance data (including thermal, hydraulic, electrical, and mechanical data). Calibrated instrumentation should be used when performing these activities (see 10 CFR 830.122(e) (4) and (h) (2)). The methods of implementation should include procedures, checklists, or other guidance documents necessary to conduct these activities.

Cognizant System Engineers should maintain cognizance over performance monitoring activities on assigned systems. Their responsibilities should include the identification of performance goals and acceptance criteria consistent with the associated SSC design requirements. Reviewing trend graphs of collected equipment data at specified intervals is a proven, effective approach. For example, if the trend graph indicates that the equipment likely will not meet the acceptance criteria at or before the next scheduled test, an adjustment in the test schedule and other maintenance actions would be necessary. Recognition of interfaces with existing maintenance program requirements is necessary. Surveillance testing is typically performed to satisfy regulatory, code, or other requirements to ensure operability of the equipment within established limits. The results of surveillance testing should be used to detect and correct any deficiencies that cause the equipment to deviate from the design requirements. Surveillance testing techniques are similar in many ways to those used in SSC performance monitoring. The results of surveillance testing should be reviewed and trended, and necessary corrective actions taken to return equipment performance to within the design requirements. The periodic equipment performance monitoring function should take credit for periodic surveillance testing, where appropriate. Periodic testing, beyond that in the TSR surveillance requirements, may be adjusted both in frequency and degree of technical content based on the importance of the SSC or the particular SSC function. The origin of various testing requirements should be documented and maintained in the MIP as specified in DOE O 433.1, *Maintenance Management Program for DOE Nuclear Facilities*.

Contractors should include the design engineers, as well as Cognizant System Engineers, in the periodic review of operating and maintenance procedures to alert maintenance and other organizations to any design changes in the affected systems.

7.7 Resolution of Open Items

Contractors should document assessment findings as open items if they are validated to involve one or more of the following:

- contradictory information from different source documents
- unanswered technical questions
- missing, undocumented or inaccurate information

The contractor should establish a formal, documented process for resolution of open items. That process should include tracking the open item to completion and closeout, including documentation of the resolution. Any identification or a potential inadequacy of the DSA should be assessed through the USQ process.

APPENDIX A - REFERENCES

The following documents are either referenced within this standard or were considered during the development of this standard.

Federal Regulations	http://www.access.gpo.gov/ecfr/
10 CFR Part 830	*Nuclear Safety Management*
29 CFR 1910.119	*Process safety management of highly hazardous chemicals*
36 CFR Chapter XII, Part 1220	*Federal Records, General*
48 CFR 945.102-71	*Maintenance of Records*
48 CFR 970.0470	*Department of Energy Directives*
48 CFR 970.5204-2	*Laws, Regulations, and DOE Directives*
48 CFR 970.5223-1	*Integration of environment, safety, and health into work planning and execution*
DOE Directives (Policies, Orders, Manuals, and Guides)	http://www.directives.doe.gov/
DOE G 200.1-1	*Software Engineering Methodology*
DOE G 414.1-1A	*Management Assessment and Independent Assessment Guide*
DOE G 414.1-2	*Quality Assurance Management System Guide for use with 10 CFR 830.120 and DOE O 414.1*
DOE G 420.1-2	*Guide for the Mitigation of Natural Phenomena Hazards for DOE Nuclear Facilities and NonNuclear Facilities*
DOE G 421.1-2	*Implementation Guide For Use in Developing Documented Safety Analyses To Meet Subpart B Of 10 CFR 830*

DOE G 423.1-1	*Implementation Guide For Use In Developing Technical Safety Requirements*
DOE G 424.1-1	*Implementation Guide For Use In Addressing Unreviewed Safety Question Requirements*
DOE G 430.1-1	*Project Controls*
DOE G 430.1-5	*Transition Implementation Guide*
DOE G 433.1-1	*Nuclear Facility Maintenance Management Program Guide for Use with DOE O 433.1*
DOE G 435.1-1	*Implementation Guide for use with DOE M 435.1-1*
DOE G 450.4-1B	*Integrated Safety Management System Guide*
DOE Manual (M) 435.1-1	*Radioactive Waste Management Manual*
DOE O 412.1	*Work Authorization System*
DOE O 413.1A	*Management Control Program*
DOE O 413.3	*Program and Project Management for the Acquisition of Capital Assets*
DOE O 414.1A, Chg 1	*Quality Assurance*
DOE O 420.1A	*Facility Safety*
DOE O 430.1A	*Life Cycle Asset Management*
DOE O 433.1	*Maintenance Management Program for DOE Nuclear Facilities*
DOE O 452.2B	*Safety of Nuclear Explosive Operations*
DOE O 5480.19	*Conduct of Operations Requirements for DOE Facilities*
DOE O 5480.20A	*Personnel Selection, Qualification, and Training Requirements for DOE Nuclear Facilities*

DOE P 450.4	*Safety Management System Policy*
DOE Technical Standards	http://tis.eh.doe.gov/techstds/
DOE HDBK 1101	*Process Safety Management for Highly Hazardous Chemicals*
DOE HDBK 3027	*Integrated Safety Management Systems (ISMS)*
DOE STD 1027	*Hazard Categorization and Accident Analysis Techniques for Compliance with DOE Order 5480.23, Nuclear Safety Analysis Reports*
DOE STD 1051	*Guideline to Good Practices for Maintenance Organization and Administration at DOE Nuclear Facilities*
DOE STD 1065	*Guideline to Good Practices for Postmaintenance Testing at DOE Nuclear Facilities*
DOE STD 1121	*Internal Dosimetry*
DOE STD 3003	*Backup Power Sources For DOE Facilities*
DOE STD 3006	*Planning and Conduct of Operational Readiness Reviews*
DOE STD 3009	*Preparation Guide for U.S. DOE Nonreactor Nuclear Facility Safety Analysis Reports*
DOE STD 3011	*Guidance For Preparation of DOE 5480.22 (TSR) and DOE 5480.23Implementation Plans*
DOE STD 3024	*Content of System Design Descriptions*
DOE STD 6002	*Safety of Magnetic Fusion Facilities: Requirements*

DOE Technical Standards	http://tis.eh.doe.gov/techstds/
DOE STD 6003	*Safety of Magnetic Fusion Facilities: Guidance*

Other DOE References

Defense Programs Safety Information Letter, Issue No: 95-04	*Management of Safety Analysis Report Information Using Standard Configuration Management Practices*

Other Government Standards

MIL-STD-973, 17 April 1992	*Military Standard Configuration Management*

Other Commercial Nuclear Industry Documents

American Society of Mechanical Engineers (ASME) NQA-1-2000	*Quality Assurance Requirements for Nuclear Facility Applications*
Electronics Industries Alliance (EIA)-649, August 1998	*National Consensus Standard for Configuration Management*
IAEA-TECDCO-1335, January 2003	*Configuration Management in Nuclear Power Plants*
Institute of Nuclear Power Operations (INPO) AP-929, May 1998	*Configuration Control Process Description*
INPO 87-006, July 1987	*Report on Configuration Management in the Nuclear Utility Industry*
International Organization for Standards (ISO) 10007:1995(E)	*Quality Management – Guidelines for Configuration Management*

APPENDIX B - GLOSSARY

As-built documentation. Documentation (for example, Piping and Instrument Diagrams, and database records) verified by physical inspection as depicting the actual physical configuration and verified as consistent with the design requirements.

As-found. Information, often in the form of marked-up documents that reflects the actual physical configuration and identifies any discrepancies with currently approved facility documentation.

Assessment. For engineering applications, the process of estimating the value of something using authoritative expert judgment based upon observations of representative cases and rough calculations, rather than determining the exact value based upon comprehensive and detailed examinations, and precise and rigorous complete calculations.

Authorization agreement. A documented agreement between DOE and the contractor for high-hazard facilities (Hazard Category 1 and 2), incorporating the results of DOE's review of the contractor's proposed authorization basis for a defined scope of work. The authorization agreement contains key terms and conditions (controls and commitments) under which the contractor is authorized to perform the work.

Authorization basis. Those aspects of the facility design basis considered important to the safety of facility operations and therefore relied on by DOE to authorize operation. The authorization basis is described in documents such as the facility documented safety analysis and other safety analyses, hazard classification documents, the Technical Safety Requirements, DOE-issued safety evaluation reports, and facility-specific commitments made in order to satisfy DOE Orders or policies.

Change. Any alteration or addition, temporary or permanent, to the facility physical configuration, facility documentation, or design requirements is considered to constitute a change. Changes not within current design requirements involve design changes. Identical replacements are not changes.

Change control. A process that ensures all changes are properly identified, reviewed, approved, implemented, tested, and documented.

Change control package. The change control package is the documentation that accompanies a change to a facility, activity, or operation from the planning and initiation through completion of the implementation and testing. The change control package documents the following as applicable:

- The description of the proposed change sufficient to support technical and management reviews prior to approval;
- The name and organization of the requester;
- The description of the potentially affected SSCs;
- The reason for the proposed change and any known schedule issues;
- A list of the alternative solutions considered and the results;
- The date by which the decision about the change needs to be completed to facilitate timely implementation or to allow implementation to occur concurrent with other activities, such as a planned maintenance shutdown;
- Constraints; and
- Any other information needed to review, track, approve, or process the proposed change.

It also includes related information such as:

- Change request
- Design package

- Installation package
- Post-modification testing documentation

Change traveler. A form used to transmit the change control package.

Comprehensive search. A process through which broad spectrums of documents that may contain design information are identified, retrieved, and evaluated. Key steps involve locating and screening documents that may contain design information and reviewing them to extract design information.

Cognizant system engineer. The engineer assigned technical responsibility for a particular system, who coordinates technical activities related to the assigned system. The Cognizant System Engineer has technical understanding of the system requirements design, operation, testing and maintenance. The Cognizant System Engineer ensures that relevant documents, such as system design descriptions, technical drawings, diagrams, lists, and procedures for surveillance, testing and maintenance are complete, accurate, and up to date. The Cognizant System Engineer may also keep vendor technical information and appropriate files concerning system history of repairs, modifications, operational problems, and other unique conditions or circumstances. Equivalent terms include: cognizant engineer, system engineer, system specialist, and subject matter expert.

Configuration. Configuration is the combination of the physical, functional, and operational characteristics of the structures, systems, and components (SSCs) or parts of the existing facility, operation, or activity. (NQA-1)

Configuration baseline. A configuration baseline consists of all approved documents that represent the definition of the product at a specific point. (ISO 10007:1995(E))

Configuration control board or configuration board. The Configuration Control Board is a collection of technical, management, and administrative experts assigned the authority and responsibility to make decisions on the configuration and its management.

Configuration management (CM). Configuration management is a disciplined process that involves both management and technical direction to establish and document the design requirements and the physical configuration of the nuclear facility and to ensure that they remain consistent with each other and the documentation.

Configuration management structures, systems and components (CM SSCs). CM SSCs are the set of structures, systems, and components that are managed under the configuration management process when changes are proposed and implemented. At a minimum, the CM SSCs include the safety SSCs as identified in the documented safety analysis, the Vital Safety System SSCs and other defense-in-depth SSCs. They may also include SSCs related to:

- Environmental safety
- High cost
- Critical mission capability
- Critical software capability
- Adjacent SSCs that could affect safety.

Defense-in-depth. Defense-in-depth describes the multiple equipment and administrative features that together are relied upon to provide preventive or mitigative functions to a degree proportional to the potential hazard.

Design assessments. Design assessments are performed to ensure that design documents have been updated to reflect changes and accurately reflect the physical configuration of the nuclear facility.

Design authority. The organization responsible for establishing the design requirements and ensuring that design output documents appropriately and accurately reflect the design basis. The design authority is responsible for design control and ultimate technical adequacy of the engineering design process. These responsibilities are applicable whether the process is conducted fully in-house, partially contracted to outside organizations, or fully contracted to outside organizations.

Design basis. Design basis consists of the design inputs, the design constraints, and the design analysis and calculations. It includes topical areas such as seismic qualification, fire protection, and safe shutdown. The design basis encompasses consideration of such factors as facility availability, facility efficiency, costs, and maintainability, and that subset that relates to safety and the authorization basis. The design basis explains why a design requirement has been specified in a particular manner or as a particular value.

Design documents. Design documents define either the design requirements or the design basis of the facility. Design documents include design specifications, design change packages, design drawings, design analysis, setpoint calculations, summary design documents, correspondence with DOE that provides design commitments, and other documents that define the facility design.

Design information. The combination of design requirements and design basis information associated with the design process, consisting of design inputs, design constraints, design analysis and calculations, and design outputs.

Design reconstitution. An adjunct program to the configuration management process that accomplishes the one-time effort of identifying, retrieving, extracting, evaluating, verifying, validating, and regenerating missing critical design requirements and basis. Design reconstitution encompasses the following functions: developing associated program plans and procedures; identifying and retrieving design information from identified source documents; evaluating, verifying, and validating the design information; resolving discrepancies; regenerating missing critical design information; and preparing and issuing Design Information Summaries .

Design requirements. Those engineering requirements reflected in design output documents (such as drawings and specifications) that define the functions, capabilities, capacities, physical sizes and dimensions, limits and setpoints, etc. specified by design engineering for a structure, system, and component. The design requirements provide the results of the design process.

Discrepancy. As used in this standard, a discrepancy is an inconsistency among the physical configuration, the design, and the documentation.

Document. Document means recorded information that describes, specifies, reports, certifies, requires, or provides data or results.

Document control. The act of assuring that documents are reviewed for accuracy, approved for release by authorized personnel, and distributed to and used at the location where the prescribed activities are performed. (NQA-1)

Documented safety analysis (DSA) Documented safety analysis means a documented analysis of the extent to which a nuclear facility can be operated safely with respect to workers, the public, and the environment, including a description of the conditions, safe boundaries, and hazard controls that provide the basis for ensuring safety.

Environmental design requirements. In the context of the configuration management process, those design requirements that are necessary to protect the environment, and to satisfy environmental requirements and permits, as well as other related DOE requirements.

Equipment failure. Equipment failure is defined as a condition in which equipment can no longer perform their design requirements.

Equipment database. The equipment database cross references structures, systems, and components with their design requirements, design basis, and associated documents. It is the primary source for design requirements. *See* section 4.8 of the standard.

Facility documents. Those documents that support facility operations, such as-built configuration information (such as drawings, valve lists, etc.), the facility procedures for activities (such as operations, maintenance, and testing), and facility operational records (such as completed tests, work requests, and radiation survey maps).

Formal review. A process through which design information is identified and retrieved from on-hand, top-level, summary-type design documents such as the Safety Analysis Reports, Technical Safety Requirements, and System Design Descriptions.

Graded approach. The term graded approach, when used in this standard, means the process of ensuring that the level of analysis, documentation, and actions used to comply with a requirement in this part are commensurate with:

(1) The relative importance to safety, safeguards, and security;
(2) The magnitude of any hazard involved;
(3) The life cycle stage of a facility;
(4) The programmatic mission of a facility;
(5) The particular characteristics of a facility;
(6) The relative importance of radiological and nonradiological hazards; and
(7) Any other relevant factor.

(10 CFR Part 830)

Independent design verification. Independent design verification is a verification performed by a person other than the person who performed the original design work. It is the act of checking the design or requirement, often by using a different calculation method, to verify that the structure, system or component will meet established performance criteria.

Integrated Safety Management System (ISMS). See Safety Management System.

Major modification. Major modification means a modification to a DOE nuclear facility that substantially changes the existing safety basis for the facility. (10 CFR Part 830)

Master equipment list (MEL). The master equipment list is a detailed master list of equipment, components, and structures to be included in the maintenance program. This includes both safety-related and non-safety-related systems and equipment. (DOE G 433.1-1)

Nonreactor nuclear facility. Nonreactor nuclear facility means those facilities, activities or operations that involve, or will involve, radioactive and/or fissionable materials in such form and quantity that a nuclear or a nuclear explosive hazard potentially exists to workers, the public, or the environment, but does not include accelerators and their operations and does not include activities involving only incidental use and generation of radioactive materials or radiation such as check and calibration sources, use of radioactive sources in research and experimental and analytical laboratory activities, electron microscopes, and X-ray machines. (10 CFR Part 830)

Nuclear facility. Nuclear facility means a reactor or a nonreactor nuclear facility where an activity is conducted for or on behalf of DOE and includes any related area, structure, facility, or activity to the extent necessary to ensure proper implementation of the applicable requirements. (10 CFR Part 830)

Open item. A validated situation involving: apparent contradictions from different source documents; concerns; unanswered technical questions; or cases of missing, undocumented, or inaccurate information.

Physical Configuration. Physical configuration means the actual physical location, arrangement, and material condition of structures, systems, and components within a facility.

Programmatic or Technical Issues. Programmatic or Technical Issues for configuration management are those important issues that might need to be resolved, or partially resolved, in order to complete the configuration management planning process.

Reactor. Reactor means any apparatus that is designed or used to sustain nuclear chain reactions in a controlled manner such as research, test, and power reactors, and critical and pulsed assemblies and any assembly that is designed to perform subcritical experiments that could potentially reach criticality; and, unless modified by words such as containment, vessel, or core, refers to the entire facility, including the housing, equipment and associated areas devoted to the operation and maintenance of one or more reactor cores. (10 CFR Part 830)

Safety-class structures, systems, and components. Safety-class structures, systems, and components are the structures, systems, or components, including portions of process systems, whose preventive or mitigative functions are necessary to limit radioactive hazardous material exposure to the public, as determined from safety analyses. (10 CFR Part 830)

Safety Design Requirements. Those design requirements that are necessary to protect off-site, on-site, and facility personnel from nuclear hazards and other hazards, such as sulfuric acid and chlorine. Safety design requirements include those necessary to satisfy DOE safety requirements.

Safety management program. The safety management program is a program designed to ensure a facility is operated in a manner that adequately protects workers, the public, and the environment by covering topics such as: quality assurance; maintenance of safety systems; personnel training; conduct of operations; inadvertent criticality protection; emergency preparedness; fire protection; waste management; and radiological protection of workers, the public, and the environment. (10 CFR Part 830)

Safety Management System (SMS). Safety management system means an integrated safety management system established consistent with 48 CFR 970.5223-1. (10 CFR Part 830)

Safety-significant structures, systems and components. Safety-significant structures, systems, and components are the structures, systems, and components that are not designated as safety class structures, systems, and components, but whose preventive or mitigative functions are a major contributor to defense in depth and/or worker safety as determined from safety analyses. (10 CFR Part 830)

Safety structures, systems, and components. Safety structures, systems, and components are both safety-class structures, systems, and components and safety-significant structures, systems, and components. (10 CFR Part 830)

Smart search. A process through which that set of documents that are most likely to contain design requirements are identified, retrieved and evaluated. Key steps involve location of the source documents most likely to contain design requirements, screening them for applicability, and reviewing them to extract design information.

SSC grade. A measure of the importance of SSCs within the facility based on the most important design requirements applicable to the SSC that can be used to determine priorities and proper levels of attention and resource allocations. An example of SSC grades and associated priorities is: (1) safety, (2) environmental, (3) mission, and (4) others.

Structures, systems, and components (SSCs). Structures are elements that provide support or enclosure such as buildings, free standing tanks, basins, dikes, and stacks. Systems are collections of components assembled to perform a function such as piping; cable trays; conduit; or heating, ventilating and air conditioning (HVAC). Components are items of equipment such as pumps, valves, relays, or elements of a larger array such as computer software, lengths of pipe, elbows, or reducers.

System Design Description (SDD). An SDD describes the requirements and features of a system. It identifies the requirements of structures, systems, and components, explains the bases for the requirements, and describes the features of the system that are designed to meet those requirements.

Technical Review The technical review is the interdisciplinary process to confirm or substantiate the technical adequacy of a proposed change and ensure that it does not substantially degrade safety margins.

Technical Safety Requirements (TSRs). TSRs are the limits, controls, and related actions that establish the specific parameters and requisite actions for the safe operation of a nuclear facility and include, as appropriate for the work and the hazards identified in the documented safety analysis for the facility: Safety limits, operating limits, surveillance requirements, administrative and management controls, use and application provisions, and design features, as well as a bases appendix. (10 CFR Part 830)

USQ review. A USQ review is a review of a situation (such as a proposed change or a newly identified potential inadequacy of the safety bases) in accordance with the DOE-approved USQ process to determine if the situation involves a USQ.

Unreviewed Safety Question (USQ). A situation involves a USQ when:

(1) The probability of the occurrence or the consequences of an accident or the malfunction of equipment important to safety previously evaluated in the documented safety analysis could be increased;
(2) The possibility of an accident or malfunction of a different type than any evaluated previously in the documented safety analysis could be created;
(3) A margin of safety could be reduced; or
(4) The documented safety analysis may not be bounding or may be otherwise inadequate. (10 CFR Part 830)

USQ Process. The Unreviewed Safety Question process is the mechanism used to keeping a safety basis current by:

(1) Reviewing potential USQs,
(2) Reporting USQs to DOE, and
(3) Obtaining approval from DOE prior to taking any action that involves an USQ.

For hazard category 1, 2, and 3 nuclear facilities, the USQ process is approved by DOE and required to meet the provisions of 10 CFR Part 830. (10 CFR Part 830)

Verification (design reconstitution). For the design reconstitution program, the process of checking that the retrieved design information has been completely and accurately translated from the source documents.

Vital safety systems. Vital safety systems are safety-class systems, safety-significant systems, and other systems that perform an important defense-in-depth safety function.

Walkdown. A visual inspection of facility structures, systems, and components to identify the as-found physical configuration and any discrepancies with currently approved facility documentation.

Work Control Process. A process that ensures all work is properly controlled, reviewed, approved, implemented, tested, and documented. The work control process should be integrated with the planning process and should include provisions for:

- Work order system
- Job planning and estimating
- Time standards
- Priority system
- Procedures and documentation
- Scheduling
- Post-maintenance testing
- Backlog work management
- Equipment repair history and vendor information
- Training and qualification standards
- Lockout and tagout provisions
- Work performance standards
- Human factors
- Engineering

(adapted from DOE G 433.1-1)

Work Control Document. A proceduralized document used by facility personnel to perform activities, such as maintenance, inspections, testing, or other work. (DOE G 433.1-1)

Work Request and/or Work Order. The work request/work order is a means of requesting services. The process may use either an electronic or paper medium. The work request/work order is issued to planners and estimators who in turn use it to help them define, plan, and execute work activities. The work request/work order should include detailed documentation of the work to be performed, the available spare parts, applicable procedures, and testing to verify maintenance was correctly performed. The work request/work order may also be used to document the completion of minor activities, such as lubrication, and light bulb replacement. (adapted from DOE G 433.1-1)

Waiver or exemption. Documented authorization to depart from specified requirements.

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APPENDIX C - ACRONYMS

AC	Alternating current
ALARA	As low as reasonably achievable
ANSI	American National Standards Institute
ASCE	American Society of Civil Engineers
ASME	American Society of Mechanical Engineers
BOP	Balance of Plant
CCB	Change Control Board
CCD	Component configuration data (sheets)
COF	Consequence of Failure
CFR	Code of Federal Regulations
CM	Configuration Management
CM SSC	Configuration Management Structures, Systems, and Components
CMO	Configuration Management Office
CP	Critical Protection
Cv	Valve flow coefficient
DCN	Document Change Notice
DCP	Design Change Package
DNFSB	Defense Nuclear Facilities Board
DOE	Department of Energy
DRR	Design Review Record
DSA	Documented Safety Analysis
EEC	Environmental Evaluation Checklist
EIA	Electronics Industries Association
ES&H	Environment, safety and health
FCN	Field change notice
FCR	Field change request
FDC	Functional Design Requirements
FM	Facility manager
FPR	Functional Performance Requirements
FSRC	Facility Safety Review Committee
G	Guide
GOCO	Government-Owned, Contractor-Operated
GOGO	Government-Owned, Government-Operated
GPM	Gallons per minute
GS	General service
HA	Hazard analysis
HDBK	Handbook
HVAC	Heating, Ventilation, and Air Conditioning
I&C	Instrumentation and Control
INPO	Institute of Nuclear Power Operations
ISO	International Organization for Standards
ISMS	Integrated Safety Management System
KV	Kilovolt
LANL	Los Alamos National Laboratory
LO/TO	Lockout/Tagout
M	Manual
M&O	Management and Operations
MC	Mission class
MDL	Master document list
MEL	Master equipment list

NCR	Nonconformance report
NCRS	Noncompliance Reports
NRC	Nuclear Regulatory Commission
NS	Nuclear safety
O	Order
OSHA	Occupational Safety and Health Administration
P	Policy
P&ID	Piping and Instrument Drawing
PMT	Plant Modification Traveler
PS	Production support
PSI	Pounds per square inch
QA	Quality Assurance
QAP	Quality Assurance Program
QC	Quality control
RWP	Radiation Work Permit
SC	Safety Class
SPHR	Screening Process Hazards Review
SRS	Savannah River Site
SS	Safety significant
SDD	System Design Description
SMS	Safety Management System (see also ISMS)
SSC	Structures, Systems, and Components
STD	Standard
TSR	Technical Safety Requirement
USQ	Unreviewed Safety Questions
USQD	Unreviewed Safety Question Determination
YR	Year

APPENDIX D - REGENERATION/RECOVERY/DOCUMENTATION OF REQUIREMENTS, BASES, AND ENGINEERING INFORMATION

For new construction, i.e., new facilities and major modifications to existing facilities, the design requirements should be identified and documented as part of the design process. The design requirements define the facility physical configuration and the functions of its parts. However, for existing facilities that may lack thorough documentation of the design basis, the requirements for previously installed SSCs may not be documented or available. In these cases, it may not make sense from a cost perspective to immediately reconstruct the design requirements; although the contractor should document the new or revised design requirements as maintenance and modifications are performed at the facility or activity. In any event, the contractor must ensure that the SSCs can perform the safety functions assumed in the DSA. If additional information is needed to establish the design requirements or to ensure that a SSC is capable of performing its assumed safety function, this documentation can be obtained by regenerating the information or interviewing technical experts who are knowledgeable about the particular equipment or situation.

Maximum advantage should be taken of pertinent existing safety analyses and design information (i.e., requirements and their bases) that are immediately available or can be retrieved through reasonable efforts. Missing information can often be found through the identification and evaluation of existing engineering documents (e.g., drawings, calculations, analyses, and documented justification to support engineering judgments).

As a part of the evaluation effort described above, selected design material may need to be reverified for accuracy and applicability. The need for reverification should be reserved for those design documents for which the accuracy of the original calculations/analyses is uncertain. Reverification also addresses the degree of as-built variance from the current design requirements and should include techniques for physical verification such as system walkdowns. Once the design requirements are established for the facility, a rigorous program of change control and document control must be initiated to maintain the accuracy of the information. Failure to install rigorous programs of change control and document control following the establishment or verification of design requirements could result in the need for expensive, repeated efforts to reverify the information later.

Methods that have proven successful for reestablishing missing requirements information include:

- Performing reanalysis. This approach is basically equivalent to redesign. It applies the design process to determine design requirements. Although it is the most technically acceptable method for regenerating missing requirements, this

approach is typically the most expensive. This approach should be used only for the most important missing design requirements.

- Gathering and documenting information from the experience of knowledgeable engineering and operations personnel. Their memory is a valuable (and frequently undocumented) source of information, and that information could be lost through attrition, transfers, retirement and death. Following recognition of the need to identify design information, contractors should promptly initiate this activity to prevent any further loss of knowledge.

- Repeating the original design process to decide which design outputs or portions of the equipment specifications are essential and which are optional. This approach is a combination of the first two approaches. While it may not go as far as reanalysis, it does carefully consider the likely design inputs, constraints, analysis and calculations, and outputs. After reanalysis, this is the most technically acceptable method.

- Testing equipment to determine its current functionality and accepting the results as design requirements after a technical evaluation by the engineering organization. Testing might be the only practical method for showing that system performance remains adequate.

When selecting the approach to be used, the contractor should consider

- what information is already available,
- the importance of the systems and components,
- feasibility, and
- resources.

A combination of methods is often the most cost-effective approach. Throughout design requirements regeneration, the design basis resulting from the regeneration efforts should be documented. The regenerated requirements should be incorporated into the configuration management database.

Additional guidance on design basis reconstitution for a complex nuclear facility, such as a reactor, can be found in IAEA-TECDCO-1335, *Configuration management in nuclear power plants.*

APPENDIX E – EXAMPLE CHANGE REQUEST

Change Request

1. Identification Number: _____

2. Title: _____

3. Classification: **[ ] Safety SSC** **[ ] Vital Safety System** **[ ] Defense-in-Depth**
[ ] Environmental **[ ] Mission Critical** **[ ] Costly**
[ ] Critical Software **[ ] adjacent SSC**

4. Contacts

	name	organization	phone number	email address
Sponsor: (work originator/requester/funder)				
Design Engineer:				
Cognizant System Engineer(s):				

5. Description of Proposed Change: (sufficient to support technical and management reviews – add pages if needed)
_____
_____
_____

6. Description of the potentially affected SSCs: _____
_____
_____
_____

7. Reason for the proposed change: _____
_____
_____
_____

8. Schedule considerations: (any schedule constraints, such as maintenance outages when work is to be performed or date by which work needs to be completed to support mission) _____
_____

9. Alternative solutions considered: _____

10. Constraints: _____

11. Any other information needed to review, track, or process the proposed change.

Approved for Change Control Review [ ] yes [ ] no _____

Signature & date of approval authority

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APPENDIX F - EXAMPLE CHANGE CONTROL PACKAGES

This appendix contains sample formats for change control packages and change travelers on the following pages. The first, entitled "*Example Change Control Package*," was developed using information from change travelers used at different DOE sites and facilities. It illustrates the types of information typically contained on a change traveler, the steps normally taken in the change control process, and the formality of the process and is based on expected contents of a change control package to meet the guidance in Chapter 6 of this standard.

The second example, entitled "Design Change Traveler," is based on the Los Alamos (LANL) TA-55 Procedure NMT*-FMP-803, *Change control for Facility SSCs*. The third example, entitled *Plant Modification Traveler Content*, is based on the Savannah River Site Manual E7 Procedure 2.05, rev. 3.

Contractors are not required to use the example change control packages, nor are they required to meet any of the statements in the examples. The last two examples were developed by individual contractors to use at their sites. These examples are provided in this appendix for information only to assist contractors in developing their own change control packages. Contractors may use these or other forms of change control packages as appropriate. Contractors should not assume that by using these examples they are assured that the change control process is complete. Furthermore, these examples contain terms that may not be up-to-date, such as SAR or Safety Analysis Report, instead of DSA, as well as terms and actions that may not be used or appropriate at every site. In addition, these examples may not contain all of the steps necessary to meet the change control process at some sites or facilities.

Example Change Control Package

1. Identification Number (from Change Request): _____

2. Title: _____

3. Classification: **[ ] Safety SSC** **[ ] Defense-in-Depth** **[ ] MEL**
[ ] Environmental **[ ] Mission Critical** **[ ] Costly**
[ ] Critical Software **[ ] adjacent SSC**

4. Contacts and Authorities:

	Name	Organization	Phone number	Email address
Sponsor: (work originator/requester/funder)				
Design Engineer:				
Cognizant System Engineer(s):				
Technical Review Lead:				
Management Review Lead:				
Independent Design Reviewer:				
Approval Authority:				
Individual responsible for implementation of the approved change:				
Individual responsible to approve final completion of change				

5. Description of Proposed Change: (sufficient to support technical and management reviews)
_____
_____
_____

6. Location: (Site/Area/Building/Room) _____

7. Change Request Form is complete, verified accurate, and attached? [ ]

8. Deviations from current design requirements: _____

Technical Review

9. Identify technical review team members and their organizations, applicable experience and knowledge. (attached sheet)

10. **Affected SSCs:** (List the SSCs affected by the proposed change. Identify their classification levels. Reference their documented design requirements. See item 3 above for classification levels. Use continuation sheets as necessary)_____

_____

11. **Are there design changes associated with the proposed change?** **[ ] yes [ ]no**

If yes, complete item 12.

12. **Design review complete and attached or referenced: [**Verifies that all SSCs involved in or affected by the change have been identified (and properly classified where appropriate), that the requirements for SSCs have been documented, that appropriate reference documents are listed, and the design criteria are listed.] [ ] yes

13. **Independent verification complete?** [ ] yes

14. **Interdisciplinary review of proposed change complete?** [ ] yes

15. **Will the change significantly degrade safety or negatively impact adequate protection of workers, the environment, or the public?** [ ] no [ ] yes, and proposed change is rejected.

16. **Identify the requirements and standards that apply to the change.** (attach list)

Management Review

17. **Was the technical review adequately performed?** (adequately performed according to review procedures)

[ ] yes [ ]no, return for completion

18. **The work control package is complete, ready for implementation, and attached?** [ ] yes

19. **The necessary approvals have been obtained and are attached.** [ ] yes

20. **Identify the source(s) of funding to implement the change and update the documentation.**

_____

_____

_____

21. **Is the change necessary, and if so, why?**

_____

_____

22. **Do the benefits of the change warrant the costs?** [ ] yes

USQ Review Questions

23. **Is a USQ review required for the proposed change?** [ ] yes [ ] no

24. **If yes, has the USQ review been completed?** [ ] yes

25. Does the change involve a USQ? [ ] yes [ ] no

26. If the change does involve a USQ, has it been approved by DOE? [ ] yes

27. Identify the methods and acceptance criteria for the post-modification testing (attach).

28. Are all other required reviews complete (identify in table below)? [ ] yes

Area	Req'd (yes/no)	Assigned reviewer				Comments (yes/no)	Signature/date
		Name	Org	Phone	Email		
Operations							
ALARA							
ES&H							
Maintenance							
Security							
OSHA							
QA							
Training							
Management							
System							
Other ↓							

29. Identify and track the changes to the documents affected by the change in the table below.
Documents include safety analyses; TSRs; hazard and accident analyses; USQ determinations; authorization bases; studies, analyses, and calculations performed to support the change; SDDs; MELs; MDLs; field change requests (FCRs); setpoint tables; M&TE database; maintenance lists; procurement specifications; spare parts lists; procedures; training materials; drawings; diagrams; sketches; manuals; ISM descriptions; QAPs; and implementation plans.

Document		Tracking No.	New Rev. No.	Affected pages/ sections	Req'd to operate		Contact	Document update complete and distributed (print name, initial, date)
No.	Title				yes	no		

30. Specify any installation conditions or instructions related to the change. _____

_____

_____

31. Has the implementing organization reviewed the change and confirmed it can be implemented as proposed? [ ] yes

_____ _____
Signature of approval authority to authorize implementation date

_____ _____
Signature of authorized individual certifying completion date

Design Change Traveler

(Example based on LANL/TA-55 Procedure
NMT8-FMP-803, *Change Control for Facility SSCs*)

1. Initiate Design Change Package (DCP)

This section provides general background information concerning the DCP, specifically:

- Unique Identification Number (DCP-YR-Sequential # - Rev#)
- Title and brief description of change
- System Grade [safety-class (SC), safety-significant (SS), mission class (MC), balance-of-plant (BOP)]
- Consequence of Failure (COF) Category (M1, M2, M3)
- Cognizant engineer and organization
- Design engineer and organization
- Design reviewer and organization
- Required technical discipline reviews (air monitoring, architectural, criticality, electrical, fire protection, gas systems, gloveboxes, health physics, HVAC, mechanical, seismic, waste, other)

2. Develop Design and Design Documentation

This section of the traveler identifies the required design documents and safety analyses that are to become part of the DCP:

- Design Document Index (always required) – Lists all design documents (including drawings, figures, calculations, specifications, etc.) developed or revised in support of the change. This information is used to ensure all required documentation is completed, the Master Document List (MDL) is updated, and the Field Change Requests (FCRs) logged.
- Detailed Design (required for SC/SS SSC and Title 1 changes) – Describes the purpose of the change, the design basis and design criteria for the change, the functional and performance requirements for the change, all other system topical area requirements (e.g., electrical, structural), applicable codes and standards, description of the design and all interfaces, and a listing of applicable references (studies, reports, supporting documents) used to develop the design.
- Installation Instructions (required for high risk or complex installations) – Identifies prerequisites for field installation, such as compensatory measures, operating modes, equipment required to be operable, work permits, etc. Also identifies precautions to be taken such as LO/TO and other personnel safety precautions, situations to avoid, special instructions, QC hold points, and steps that require independent verifications, sign off or initials.
- Post-Modification Testing (required for all SC/SS/MC SSCs) – Specifies all post-modification testing, inspections, and examinations required to verify that the modified/impacted SSCs satisfy their design and functional requirements and

have not inadvertently degraded associated SSCs during the construction/implementation process, prior to placing them in service. Clearly specifies explicit acceptance criteria for each test, inspection, and examination, records the actual results (or references an attached completed test plan/procedure that shows the actual results), and identifies the personnel performing and witnessing the post-modification testing activities and has them sign and date the test documentation as appropriate.

- ❖ Pre-Operational Requirements – Identifies documents and actions that must be completed prior to making the modified/impacted SSCs operational, such as obtaining environmental permits, performing necessary training, updating procedures and drawings, obtaining DOE approval if a TSR change is involved, etc.
- ❖ Post-Operational Requirements – Identifies all action, that although not required to be completed prior to releasing the modified/impacted SSCs to the user for operation, must be initiated and tracked to completion to support the DCP (e.g., MDL updated, special maintenance training, issue new or revised manuals, etc.)
- ❖ USQ Review – (always required) – Perform USQ screen and, if positive, perform a USQD in accordance with procedure 544-GEN.
- ❖ SAR/TSR Revision Notice – Identifies all proposed SAR and TSR revisions resulting from the change.

3. Design Verification

- ❖ Design Reviews (always required) – This is an independent design verification (performed in accordance with procedure NMT8-FMP-807) that involves deliberate, critical assessment of the technical adequacy and completeness of design documents, ensures that the design adequately fulfills the technical requirements and complies with applicable regulatory and industry codes and standards, and ensures that the change is within the approved design and safety envelope as defined in the relevant authorization basis documents (SAR, TSRs, Hazard & Accident analyses). The review is formally documented on Design Review Record (DRR) Sheets that become part of the DCP. The technical disciplines involved are identified in Section 1 Above. [2]

[2] **Note: Additional information from 564-GEN,** *Controlling Process Changes***: The procedure provides the process for screening and reviewing all new and modified processes and experiments and directly related process equipment. The individual operating groups are responsible for ensuring that operations under their charge remain within their approved safety envelope; providing the information needed by NMT-8 for performing safety evaluations and for updating safety analyses documentation as needed; and seeing that all changes receive the appropriate level of review and approval prior to their implementation. The CCB reviews and approves conceptual and final designs, and approves significant field changes required during construction. Management reviews shall be conducted through the CCB to ensure that the technical reviews have been performed adequately, change records are complete and ready for implementation, all necessary approvals have been obtained, and the change is authorized for implementation. The facility hazards analysis and the HA screening form are used to evaluate the safety impacts of a proposed process change and to document the findings. The HA screening process involves USQ Screens, and preparation of an HA Update form if needed.**

- E&H Review – Requires completion of a checklist to determine if hazardous materials (radionuclides, biological hazards, carcinogens, toxic gases, etc.), their transportation, decontamination activities, or generation of waste are involved. If so, the appropriate site organizations/committees are notified.
- Other Topical reviews (ALARA, Training, Security, OSHA) – Similar to ES&H reviews, the appropriate committees are notified if the modified/impacted SSCs involve these specialized topical areas.

4. Design Approval

- Change Control Board (CCB) Approval – Required at Configuration Management Office (CMO) discretion, when the DCP is large of complex or significantly impacts operation, or involves a line item project.
- Facility Safety Review Committee (FSRC) Approval – Required whenever a positive USQ is involved, or at CMO discretion.
- User Approval (Required if desired by user)
- CMO Approval (always required)
- Facility Manager (FM) Approval (always required)

5. Release for Construction

Verifies that MDL has been updated to reflect all pending changes to affected design documents.

6. Construction, Test, and Document

Consists of a checklist to verify that the DCP is complete prior to releasing the change to the user. Verifies construction in complete, that Work Orders are attached, that post-modification testing is complete and that the results are acceptable, that the design document index is complete and updated, that design drawings have been red-lined to reflect as-built conditions, that all pre-operational requirements have been completed, that glovebox certification is complete if required, and all Field Change Requests (FCRs), if any, are complete, and attached (with red-lined drawings where applicable).

7. Release to User

- CCB Approval – Required if substantial changes were made since prior CCB approval, or was made a condition by the CCB during their prior review.
- FSRC Approval – Required for positive USQDs, and where required by the FSRC as a condition of their approval.
- CMO Approval (always required)
- User Acceptance for Use (always required)
- FM Release to User (always required)
- Close DCP

Ensures post-operational requirements are tracked to closure, that all drawings have been formally revised and issued to reflect as-built facility conditions, that the MDL has been updated, and that the DCP is complete and satisfactory for transmittal to records management for storage.

Plant Modification Traveler Content

(Example based on SRS Manual E7 Procedure 2.05 Rev.3)

This Plant Modification Traveler (PMT) issued for any modification that involves a configuration item (it is not used for temporary, modifications, or setpoint changes).

Step	Item	Required Information/Action	Comments
1	Table of modification	⇐	Sort and Descriptive
2	Modification No.	⇐	Obtained by Modification Manager (Mod. Mngr) from Records Management/Document Control Organization
3, 4,5	Location of Modification	Site Area; Building; and Room	List all affected areas/buildings/rooms
6,7	Equipment Involved in Modification	System Identification No.; Component Identification No.	Provide system/component names(s), numbers(s), or other identifier(s)
8	Work Request Project No.	⇐	Provide authorization document No.
9	Required completion date	⇐	
10	Task Sponsor	Name, Department, and Phone Number	Person requesting the work (task originator)
11		Name, Department, and Phone Number	Person to contact for additional information or clarification concerning the modification if other than the task sponsor/originator
12		⇐	Describe in sufficient detail to be clearly understood by engineers performing the task(s). Include appropriate sketches and diagrams. Attach relevant information or use continuation sheets. If modification is in response to a non-conformance, list NCR No.
13	Proposed Solution	Provide proposed/suggested solutions/approaches	
14a	Technology Risk Screen	Determine whether modification is Low Technology Risk (yes or no)	Determined by Mod. Mngr. Using established guidelines/procedures
14b	Functional Requirements	Lists specific requirements or reference and attach documents containing the requirements (e.g., pressure, temperature, flow, current, etc.)	Nuclear Safety (NS) and Critical Protection (CP) modifications with construction costs ≥ 50 K, and Production Support (PS) or General Service (GS) mods ≥ 50 K that involve High or Medium Technical Risk, require preparation of 1) Functional Performance
15	Design Criteria	List applicable DOE Orders, SRS Engineering Standards, National Consensus Codes and Standards, National, State, and Local Regulations/Requirements	

Step	Item	Required Information/Action	Comments
16	Special Quality Requirements	⇐	Requirements (FPR) and 2) Functional Design Criteria (FDC) documents per Manual E7, Procedures 2.10 and 2.11.
17	Special Operability/Maintainability/Test ability Requirements	⇐	
18	Other Required Design Output Reviewers	Identify other special approvals required based on the technical scope of the modification.	For example, interfacing or support organizations, special committees, etc.
19	Design Input Change Contact	Name, Department, and Phone Number of person responsible for reviewing proposed changes to the design input	Technical agency or Mod. Mngr.
20	Modification Manager	Name, Department, and Phone Number	
21	Screening Process Hazards Review (SPHR)	Indicate whether a SPHR is required (yes or no), and if yes, provide the SPHR No.	
22	Functional Classification	Designate as one of the following: NS CP PS GS	Select the highest functional classification or the SSCs involved.
23	CCB Reviews	Indicate whether CCB review and approval is required (yes or no)	CCB review and approval is required for all NS and CP designations, and when requested by the responsible division/department
24	USQ Screening	Indicate whether USQ screening was performed (yes or no). If yes, provide USQ Screen No.	Any modification with potential impact on facility authorization basis must have a USQ screen performed
25	Environmental Evaluation Checklist (EEC)	Indicate whether EEC review is required (yes or no)	
26	Design Authority Approval	Signature (and date, department, and phone number) of appropriate Design Authority Representative	Signifies that the design input information for the modification is acceptable.
27	Other Approvals	Signatures (and date, department, and phone number) of other reviewers whose approval is requested/required	
28	Approval in Concept	Signature of Task Sponsor or Mod Mngr	If required (optional – if required by department/division)
29	Design Agency Acceptance	Signature (and date, department, and phone number) of appropriate Design Agency representative	Signifies acceptance of the design input provided for the modification (information received is sufficient and complete)
30	Design Output Documents	List all design output documents related to the task	May include PHAs, FDDs, SDDs, DCP, Calculations, Procurement Specifications, drawings/diagrams, permits, etc.
31	Functional Acceptance Criteria	Reference the document or attachment that contains the post-modification acceptance/test	

Step	Item	Required Information/Action	Comments
		criteria	
32, 33, 34, 35, 36	Document Changes	Identification of documents requiring revision; specific item requiring change; person to be contacted for information about the change; whether the change is required to operate; document change request tracking Nos.	
37	List additional installation procedures, DCFs, NCRs, etc.	⇐	Mod Mngr of implementing organization/agency lists DCPs, NCRs, DCFs, (design change form = FCR- field change request), etc. that are prepared during installation of the requested work
38	Requirements met for package closure	Signature of Mod Mngr	Signifies that installation is complete and that the Design Agency may incorporate the change
39	Approval	Signatures of any other persons whose approval is required	May be the user of the modification
40	Drawing Changes Incorporated	Signature (and date, department, and phone number) of appropriate Design Agency representative	Signifies that all changes have been incorporated into the affected drawings

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APPENDIX G - CONDUCT OF WALKDOWNS

This appendix provides an overview and discussion of selected key issues related to configuration management walkdowns.

A generic configuration management component walkdown procedure is provided for use in developing detailed walkdown procedures. The following discussion addresses selected key issues that should be considered when developing a walkdown program.

Walkdown Objectives. The objectives of the configuration management walkdowns are to:

- Establish the as-found physical configuration of the facility and
- Identify any discrepancies between the as-found configuration and associated facility documentation.

Critical Component Characteristics. Central to the success of the walkdown effort is the identification of critical component characteristics. These characteristics provide the structure for the component data sheets, which are used to collect, document, and transmit the data for inclusion into the equipment database. Prior to the commencement of the configuration management walkdowns, critical characteristics for each system and component should be identified in the walkdown procedures. Acceptable sources for these characteristics are the available design requirements, industry codes and standards, comparison of the critical characteristics with similar systems and components, and engineering judgment. The following are examples of some critical characteristics for mechanical, electrical, and instrumentation and control components:

Mechanical Components:

- Component number
- Flow diagram number
- Manufacturer
- Model number
- Serial number
- Style/type
- System
- Size (e.g., pipe size, flow, critical velocity, etc.)
- Pressure rating
- Temperature rating
- Material
- Operator type (if applicable)
- Orientation
- Other (e.g., locking devices, extensions, etc.)

Electrical Components

- Component number
- Drawing number (e.g., schematic, one-line diagram, etc.)
- Manufacturer
- Model number
- Serial number
- Component type
- Power (watts)
- Voltage (e.g., 125 DC, 4KV AC, etc.)
- Amperage
- Contact rating
- Other (e.g., environmental qualification, fuse type, location, etc.)

Instrumentation and Control Components

- Component number
- Drawing number
- Manufacturer
- Model number
- Serial number
- Style/type
- Range
- Input (e.g., psi, milliamperes, inches, H_20, etc.)
- Output
- Pressure rating
- Power
- Voltage (if applicable)
- Amperage (if applicable)
- Other

Methodology. The following generic configuration management walkdown procedure incorporates good practices and successful features of numerous configuration management walkdown efforts performed throughout the industry. By design, it is conceptual and not facility-specific but will provide general guidance and a basic foundation from which to develop a detailed configuration management component walkdown procedure.

CONFIGURATION MANAGEMENT
GENERIC WALKDOWN PROCEDURE
CONTENTS

1.0 PURPOSE.

This procedure describes the responsibilities and steps necessary to perform walkdowns for the purpose of establishing the as-found physical configuration of the facility, and identifying any discrepancies with the associated facility documentation.

2.0 OBJECTIVES.

The objectives of the configuration management walkdowns are to:

- Establish the as-found physical configuration of the facility
- Identify any discrepancies between the as-found configuration and associated facility documentation

3.0 SCOPE.

This document applies to all formal efforts by facility and contractor personnel to reconstruct missing data or field-verify existing equipment database information through walkdowns on mechanical, electrical, and instrumentation and control (I&C) systems. This will be accomplished by performing the walkdowns on a system-by-system basis to identify the as-found physical configuration and to obtain missing nameplate data for inclusion into the configuration management equipment database.

4.0 REFERENCES.

The following are examples of relevant types of documents that should be identified and referenced In support of this walkdown effort:

- Drawings (e.g., P&IDs, schematics, location drawings, vendor drawings, etc.)
- Operations Procedures (e.g., system startup, system operations, etc.)
- Quality Assurance (QA) Procedures (e.g., non-conformance items, field deviation notices, drawing change notices, independent verification, etc.)
- Equipment Database Procedures
- Engineering Procedures
- Maintenance Procedures (e.g., work request, scaffold erection, etc.)
- Security and Safeguard Procedures
- Radiation Protection Procedures (if applicable)
- Special Requirements covering environmental qualification, fire protection, etc.
- Documented Safety Analysis

5.0 KEY DEFINITIONS.

Walkdown: A visual inspection of facility SSCs to identify the as-found physical configuration and any discrepancies with currently approved facility documentation.

Nameplate: The plate or label attached to a component by the manufacturer to provide applicable component identification and design data, such as temperature, pressure, flow etc.

Walkdown team: Personnel responsible for gathering information during the walkdown, and for verifying and documenting the accuracy and completeness of this information. For this effort, each walkdown team should consist of at least two qualified personnel.

Second Party Verification: Verification of the data gathered during the walkdown by a second member of the walkdown team. Periodic sampling by QA/quality control (QC) personnel may also be performed, as appropriate.

Component Configuration Data (CCD) sheets: The method used for documenting both the component nameplate data and the independent verification. The CCD sheets will also be the mechanism for identifying missing nameplates or for transferring acquired data into the equipment database. Attachment A provides an example CCD.

Configuration Management Equipment Database: The computerized database that contains facility component information such as the design requirements, manufacturer's identification numbers, etc.

Piping and Instrumentation Drawing (P&ID): A drawing that graphically displays the process for each facility system and depicts the relevant components within each system. The P&ID also shows the functional relationship between components (e.g., first a pump, followed by an isolation valve, then a tank, etc).

6.0 PRECAUTIONS AND LIMITATIONS.

At nuclear facilities, a radiation work permit (RWP) is required for each walkdown performed inside the radiation-controlled area and shall be obtained in accordance with the applicable facility procedures.

All relevant facility safety practices shall be in effect and shall be followed, as appropriate (e.g., use of hard hats, ear protection, eye protection, scaffolding erection, chemical hazard protection, etc). Minimal risk to personal safety will be exercised in obtaining walkdown information; if in doubt, ask for assistance.

Components shall not be operated, disassembled, or affected in any way, except by authorized personnel (e.g., walkdown personnel can not change a valve position, open an energized cabinet, turn a switch, etc).

The Operations Department shall be notified and authorization obtained (e.g., from the shift supervisor, wing supervisor, or other operation's manager on shift) prior to conducting a walkdown of each system.

7.0 RESPONSIBILITIES.

The walkdown teams are responsible for:

- Conducting the walkdowns in accordance with this document and other relevant facility procedures; collecting nameplate data;
- Assuring the accuracy and completeness of the data;
- Performing second party verification of this data; documenting this verification;
- Providing the completed CCD sheets to the Walkdown Coordinator for review and further processing; and
- Ensuring that a component has not been missed during the walkdown.

The responsible Manager/Supervisor (e.g., Configuration Management Coordinator) is responsible for:

- Selecting the walkdown teams and ensuring that team members have appropriate background experience and training to be qualified to perform their role in walkdowns;
- Supervising the activities of the walkdown teams;
- Reviewing and approving the CCD sheets for completeness;
- Transmitting completed and approved CCD sheets to the Equipment Database coordinator for inclusion into the Equipment Database; and
- Initiating any follow up actions (e.g., work requests, re-walkdowns, drawing change notices, noncompliance reports (NCRS), etc.) needed to resolve discrepancies, including soliciting approval from the design authority.

The Quality Assurance/ Quality Control (QA/QC) group is responsible for:

- Reviewing the methodology and procedures used to field verify component data;

- Periodically inspecting the walkdown work in progress to ensure that it conforms to the approved procedures and that an acceptable level of accuracy is achieved;

- Identifying and tracking to completion QA/QC discrepancies; and

- Working with the walkdown teams to resolve any identified deficiencies.

8.0 INSTRUCTIONAL GUIDANCE.

All individuals associated with the component as-built configuration walkdown effort will be trained on this procedure prior to conducting the verification walkdowns.

Each walkdown team will consist of at least two individuals experienced in the use of applicable drawings (e.g., P&IDS, electrical single-line drawings and schematics, etc.). Prior to each walkdown, the walkdown team will obtain and use the latest approved revisions of the applicable drawings from the master file maintained by the Document Control Group.

The major steps to be followed by each configuration management walkdown team member are as follows:

a. Determine which system(s) or portions of systems is scheduled for a walkdown.

b. Obtain the appropriate drawings, a copy of this procedure, and an adequate number of blank CCD sheets.

c. Contact the Operations Department and obtain authorization from the operations supervisor on shift to conduct a walkdown of the scheduled system(s).

d. Consistent with the appropriate radiation protection procedures, determine and comply with the RWP requirements for the area(s) scheduled for a walkdown.

e. Upon entering the area, comply with the necessary safety requirements (e.g., ear protection, hard hats, etc.) and determine the need for special access equipment (such as ladders, scaffolding, etc.) as soon as practical. Follow proper facility procedures for acquiring and using this equipment.

   CAUTION: Do not step on cable trays, insulated pipe, hand wheels, cantilevered valves, operating equipment, or anything that may be damaged or could cause harm.

f. Conduct walkdowns of the identified system(s) or portions of systems to verify as-built configuration by gathering component nameplate data and documenting this data on the CCD sheets. Copies of the CCD sheets are included as Attachment A to this procedure.

NOTE: One or more of the team members may gather this data; however, care should be taken to insure some degree of independence (i.e., at least one member should be designated as the "first" party and a second member designated as the "second" party (independent) verifier for each component).

g. During the walkdowns, check the accuracy of the P&IDs to ensure that the functional relationships are correctly represented and that all components are accurately depicted. Annotate the drawings, as appropriate, to show the as-found configuration and retain the original for review and processing.

h. Perform the second party verification of the component nameplate data and P&ID. Both the first party and the second party verifier will sign the completed CCD sheet and P&ID, as appropriate.

NOTE: The objective of the second party verification is to ensure, by direct observation that the correct data is obtained. For example, if a valve is located overhead and access to the component nameplate is by ladder, both team members will climb the ladder to verify the information. Only one person going up and calling down to the other is not considered a second party, independent verification and is therefore unacceptable for the purposes of this step.

i. During the walkdowns, general facility material and housekeeping conditions should also be observed and any irregularities or unusual conditions should be reported in the comments/remarks section of the CCD. Examples of what to look for are as follows:

- Obvious physical damage to equipment
- Missing or illegible tags
- Loose, bent, or missing supports and/or anchors
- Valve packing glands "bottomed out" or unsymmetrical
- Leaks e.g., water, oil, steam, etc.
- Missing, bent, or broken valve handwheels
- Missing or loose cover plates
- Gagged relief valves
- Unterminated cables showing bare wire
- Missing fuses
- Unauthorized temporary modifications
- Debris

j. If the documentation becomes contaminated, the information can be transferred to non-contaminated documents and verified

accurate, by signature and date, by both first party and second party personnel. The contaminated documents may then be destroyed.

k. Record the progress of the walkdown by highlighting the applicable drawings. These highlighted drawings, along with the completed CCDs should be given to the CM Coordinator at the end of each day to keep him updated on the progress of' the walkdown effort.

l. The Responsible Manager/Supervisor should ensure the following actions are taken:

- Review the completed CCD sheets and, if approved, make copies and transmit the copies for inclusion into the database. If not approved, take whatever action is necessary to resolve the problem(s);

- Review the annotated P&IDs and submit document change notices, as required; and

- Handle the completed CCDs and associated documentation as QA records and ensure that they are maintained in controlled files for a retention period consistent with standard facility document control/records management procedures.

ATTACHMENT 1

COMPONENT CONFIGURATION DATA SHEET "SAMPLE"

VALVES

Drawing Number _____

Plant _____
Component Number _____
Manufacturer _____
Model Number _____

Pipe Size _____

Pressure _____

Unit Number _____

System _____

Style/Type _____

Serial Number _____

Cv (valve flow coefficient) _____

Temperature _____

Operator Type _____

Material _____

Remarks/Comments:

Collected by (first party) Date _____

Verified by (second party) Date _____

Approved by (Manager/Supervisor) Date _____

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